The Farmer's Digest

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Are You Feeding Vitamin A?

Condensed from Guernsey Breeders' Journal

S. R. Winters

DAIRYMEN have known for several years the importance of Vitamin A in cattle rations. An insufficient amount of this necessary vitamin spells disaster for the mature cow as well as for the calf.

Such symptoms as slow growth, general unthriftiness, scours, blindness, susceptibility to pneumonia, and even death may result when the diet of the calf contains too little vitamin A.

Mature cows fed on rations deficient in this vitamin usually begin to drop premature, weak or dead calves after about six months. In less than three years they often die or fail to become pregnant. The milk yield from such cows as calve, though only moderately reduced in quantity, becomes markedly reduced in quality. It has been demonstrated that calves fed on milk from cows getting insufficient vitamin A exhibit most of the above-mentioned symptoms.

There are at least five different substances found in natural foods which can supply vitamin A. Four of them are yellow pigments, all soluble in fats but not in water. Their chemical names are: Alpha carotene, beta carotene, gamma carotene and cryptoxanthin. The fifth is vitamin A itself which is almost colorless. Pure vitamin A has been obtained from various types of fish liver oils, cod-liver oil being the best known example.

The chemical name carotene comes from the word carrot. Most of the brilliant orange-yellow coloring of garden carrots is carotene pigment. The carotenes are closely connected with the green coloring of all plants. Light seems to be just as important for the production of carotene as for the production of green coloring (chlorophyll).

Beta carotene occurs in greater abundance in cattle feeds than do the other types of carotene. Because of the structure of its molecule, scientists say its vitamin A

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activity is about twice that of alpha and gamma carotene. It is from beta carotene that cattle get most of their vitamin A on normal rations. Therefore, it is the type with which we shall be chiefly concerned. Hereafter, when the word "carotene" is used, beta carotene is to be understood.

A cow receives at least ninety per cent of her vitamin A supply from the carotene content of her roughage. Grains are, in general, a poor source of vitamin A. Yellow corn, the richest of the grains, contains vitamin A activity in the form of cryptoxanthin, but yields a very small amount of vitamin A as compared with the roughage portion of a cow's diet.

Carotene is present in greatest abundance in young green pasture grasses and growing alfalfa. Cows on good pasture have rarely, if ever, been known to exhibit symptoms of a vitamin A deficiency. Calves fed on milk from cows on good pasture do not suffer from a lack of this essential vitamin.

When a cow is on winter feed she will get her supply of carotene from hays and silages. Of hays normally fed, U. S. No. 1 alfalfa appears, from laboratory analysis by the Bureau of Dairy Industry of the Department of Agriculture, to be the best winter source of carotene. It contains 40 parts per million. U. S. No. 1 timothy hay contains 20 p. p. m.; U. S. No. 1 clover and light timothy mixed, 18 p. p. m.; U. S. No. 3 alfalfa, 3; U. S. No. 3 timothy, 5.

Corn silage, when analyzed, often appeared to have a higher "carotene" content than the corn from which it was made, but recent work in the field has established the fact that what seemed to be an increase in carotene was due to the presence of pigmented impurities found in the silage but not in the corn. Silage is regarded by most dairymen as a fair source of vitamin A.

Alfalfa leaf meal, artificially dried, and garden carrots have a very high carotene content, more than any of the hays or silages. They are not, however, usually fed as part of normal dairy rations because of the expense involved.

Carotene content of market hays and silages is an exceedingly variable quality. The green color of hay has usually been accepted as a rough index of its carotene content. In a very general way it can be said that the greener the hay, the higher its carotene content. In a very general way it can be said that the greener the hay, the higher its carotene content. A comparison between the per cent of color and of carotene lost by several lots of hay showed the following results: While one lot of hay lost twenty-one per cent of its natural green color, it

lost nearly sixty per cent of its carotene content. Another lot decreased twenty-two per cent in natural color and over sixty per cent in carotene content. Apparently, then, the loss of carotene is about three times greater than the loss of natural green color.

Methods of curing and storing have effect on the carotene content of these feeds. About eighty per cent of the carotene content of alfalfa is lost during the first twenty-four hours of drying in the field. Artificial drying, rather than sun drying, conserves the carotene. Exposure to light and warmth during storage causes loss of carotene. Finely ground hays lose more in the grinding and afterward than those more coarsely ground. Excess of moisture in silage has a deleterious effect on the carotene.

In fact, there are so many factors involved in determining the exact quantity of carotene and of vitamin A activity present in cattle feeds that, even now, after considerable experimentation, all the problems are by no means solved.

Of significance to the practical dairyman is the experimental work being done by the Bureau of Dairy Industry, particularly at Beltsville, Maryland, to discover the amounts of carotene necessary to promote health in dairy cattle.

Since it had often been observed that cows getting poor quality hay had a great number of abnormal births (even when infectious abortion was not present) than cows on pasture, and showed other symptoms of vitamin A deficiency, an experiment was conducted at Beltsville with eleven cows to determine the amount of carotene necessary for normal reproduction.

All but one of the cows were kept off pasture. Six of them were fed on grain and timothy or clover hays which gave them an average daily intake of from eighty-two to 132 milligrams of carotene.

Of the six calves born to these cows, four were strong at birth, one was weak but survived, and one was lost in a scour epidemic which involved even calves of cows that had been on pasture.

Five of the eleven cows were fed on grain and clover or timothy hays which gave them an average daily intake of from thirty-one to fifty-seven milligrams of carotene. Of the five calves born to these cows, one died at birth, one was born dead, and one died the eighth day. Another was very weak at birth but was fed cod-liver oil and survived. The fifth calf was a strong heifer which survived, but her mother had been on pasture to about seven months before calving. She had apparently stored sufficient carotene to supplement the low

intake during the hay-feeding program.

It was concluded from this experiment that normal calvings can be had when timothy or clover hay is fed without pasture, providing the hay fed during the last months of pregnancy contains sufficient carotene. A daily carotene intake of eighty to 100 milligrams seems enough. With a daily intake of fifty to sixty milligrams, many weak or dead calves are born.

The vitamin A requirements for normal growth in calves has been shown at Beltsville to be greater than the requirements for growth in older stock. Young calves are, of course, highly susceptible to various and sundry calf ills during the first three or four months of life. They need, during that period, a more generous protection of vitamin A than at an older age.

Experiments conducted in 1932 showed that farm rations frequently fed to calves may be dangerously low in vitamin A and that milk produced by cows fed on hay which is no longer green in color may not supply enough vitamin A to insure the health of the calf. Three normal calves, born to cows which had ample supplies of carotene, were fed milk from cows which were on rations deficient in carotene content. The three calves died before they were three months old. In each case pneumonia, which is generally admitted to be a symptom of vitamin A deficiency, was present.

More than fifty calves have been used in more recent experiments to determine the best sources and proper amounts of vitamin A. Groups of them were fed (after two or three days on colostrum from their dams) milk from cows getting one of the following hays for roughage: U. S. No. 1 alfalfa, U. S. No. 3 alfalfa, U. S. No. 1 timothy, U. S. No. 3 timothy, or U. S. No. 1 clover light timothy mixed. Milk from cows on pasture was also fed.

The calves were all fed milk until they were twenty days old when skim-milk was gradually substituted. By the time they were thirty days old, they were getting all skim-milk. Low color timothy hay, which is a poor source of carotene, was also fed to the calves. A suitable grain mixture completed the ration—a feeding program in which practically all the vitamin A the calves were to get had to come from the milk.

The calves which were fed on milk from cows getting U. S. No. 3 timothy hay fared the worst. Seven of them died at ages between forty-five and eighty-nine days. In all cases, they showed typical symptoms of vitamin A deficiency: Scouring, lack of appetite, coughing and pneumonia.

Before they died, most of them stopped growing at an average of forty days, just about at the end of the whole milk-feeding period.

Three calves getting milk and skim-milk from cows on No. 1 timothy hay died at eighty-five, eighty-eight and ninety-five days. They were gaining some weight until about ten days before death.

There were two calves on milk from No. 3 alfalfa hay. One died at thirty-seven days, while the other lived seven months but was blind at four months.

On milk from clover hay one calf died at seventy-six days, one lived six months but made only sixty-nine per cent of the expected growth and was blind.

Six calves were fed on milk from cows on No. 1 alfalfa. Four of them died at ages between fifty-five and 168 days. Two survived to the age of six months and made forty-eight and sixty-eight per cent of the expected gains.

Four calves were fed on skim-milk from cows on pasture. They all survived to six months of age but made from forty to eighty per cent of the expected gains. They did better than calves on milk from the best hay because pasture grass is so much higher in carotene content. But even with the best skim-milk, calves would need a better hay than low color timothy to grow normally.

Two calves fed for the entire period on whole milk from cows on pasture did make normal growth even with the low color timothy hay. Calves on whole milk from No. 1 alfalfa hay made only seventy and seventy-eight per cent of the expected growth. This shows that even whole milk, unless it is from the best source, does not supply enough vitamin A for normal growth. The calves still need additional vitamin A either in the form of green hay or from a vitamin A supplement such as carotene in oil or cod-liver oil.

To determine the most efficient feeding program for supplying vitamin A to calves, five different rations were given to a group of twenty-two calves, again at Beltsville.

When the skim-milk plus cod-liver oil replaced the whole milk, the calves made larger gains in body weight per pound of total digestible nutrients. Of particular interest is the fact that calves getting an average of fifteen pounds of skim-milk per day with 10 cc of cod-liver oil, in the first two months gained as much as calves on the more expensive diet of eleven pounds of high vitamin A whole milk. The skim-milk fed contains only seventy per cent of the total digestible nutrients of the whole milk.

One of the most important conclusions to be drawn from this experiment is the fact that calves

can be fed on a skim-milk diet after the colostrum period if cod-liver oil is given to supply the necessary vitamin A. Depending on the amount of skim-milk fed, 10 cc or 20 cc daily is sufficient.

This and other experiments seem to indicate that where the carotene content of the rations of the nursing cow is unknown, or known to be low, cod-liver oil, or some other concentrated form of vitamin A is indicated as the best insurance of the health of the calf.

In normal dairy practice, the use of these vitamin A supplements is usually regarded as an emergency measure. In times of drought, when the growth of plants that make up the pasture has been stopped and their carotene content is destroyed by the hot sun, dairymen often find it necessary to provide a vitamin A concentrate in the diet of the cattle.

Calves which must be raised without milk from pasture grass can be safeguarded by the use of these supplements.

Dairy farms near large cities, where land values are too high to permit adequate pasture for a large herd, can support healthier cattle by making some use of the supplements.

By and large, however, the dairyman's chief concern is in insuring his cattle enough vitamin A on a normal feeding program by providing feeds with a high carotene content.

A Good Way To Spread Lime

Condensed from American Agriculturist

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THE easiest way to get lime mixed with the soil is to spread it on meadow land after haying and before plowing for another crop. Corn, which usually follows hay, is not expected to be benefited very much, if any, by lime used in this way, but the lime is in the soil where it stays moist and where it has a chance to be absorbed by the soil.

For best results lime must be mixed with the soil so it can be absorbed. It must destroy soil acidity before crops can get the benefit they need.

Lime on the surface of the soil may dry up and blow away, part of it may wash away or wash to the low parts of the field, and the rest of it would be absorbed less quickly on the surface than it is when plowed down.

After harvesting the corn or other crop that follows hay, more lime may well be applied to be plowed down. This is necessary only on very acid soil or on land that is to be improved as quickly as possible. When the second application is plowed down, what remains of the first application is plowed up.

Lime that has been plowed down, left a year, then plowed up again and still further mixed with the soil in the process of seedbed preparation has a much better chance to sweeten sour soil than lime that is spread and harrowed in just before seeding. It is much more effective even than lime that is applied and harrowed in the fall before seeding.

Lime Plowed is Where Roots Can Find It

If a second application of lime is plowed down, clover roots will find more favorable conditions at the bottom of the furrow than can possibly exist when the lime is all at or near the surface. Lime in dry surface soil is inactive and of no immediate benefit.

If only one application of lime is to be made, it is still better to spread it on meadow land that is to be plowed. Lime that is plowed down is not in a layer at the bottom of the furrow. It is distributed throughout the furrow slice even better if it is plowed in than it can be if it is harrowed in.

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The Lippizans

Condensed from The Horse

Charles Longstreth McNichols

AS far as can be ascertained at this writing the only Lippizan horses in America are the two stallions, two mares and their offspring at Winfield Sheehan's ranch in Hidden Valley, not far from Los Angeles. Certainly no such small stud anywhere in the country has received so much recent attention. Delegations of cavalry officers from Brazil, Canada and Mexico, as well as representatives of our own remount service, have been out there looking them over with a professional eye, and a big motion picture feature has just been completed, built around the lead stallion. He is carried on the studbook as *Pluto II*, but was renamed *Florian* for the picture.

Like all Lippizans, these horses are pure white in maturity and black at birth. The breed was synthesized for cavalry purposes by order of the emperor of Austria some three hundred years ago, and remained the exclusive property of the Austrian government until Mr. Hitler made his grab a couple of years ago. What is the present fate of the great Lippizan stud at Piber and the whole breed in its homeland is not known, but it is known that a detail of German officers were at Piber last year with a view to determining whether some or all of the horses should be shipped up to the German cavalry school at Hamburg.

The original stud at Lippiza (the move to Piber came after the world war when Lippiza, near Trieste, was handed over to Italy) was founded by Emperor Ferdinand of Hapsburg around 1550 when he imported six white African Barbs and thirty-six heavy black mares of various breeds from the Basque provinces and Andalusia in Spain, from Denmark and the Tyrol.

For more than a hundred years the Turkish cavalry had been giving the Austrians a rough time. The Turks were mounted on grade Arabs, light and fast. The Germans still stuck to the heavy, draft-type cavalry horse developed during the middle ages to carry a man encased in complete plate armor. The Emperor's idea was to evolve a faster, handier horse, able to compete with the Turkish mounts, but heavy enough and sturdy enough to carry the big Germans and Slavs that made up the better part of his fighting force, plus the re-

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duced, but still considerable, body armor then worn. This was a surprisingly early instance of what we now call "long term planning," for Ferdinand himself said he believed it would be a hundred years before the breed could be built up to a point where it could take care of the Austrian remount situation.

The new horses turned out to be sturdy, rather short-legged animals, quite fast, and remarkably handy. For the first few generations there seemed to have been only enough of them to meet the personal transportation needs of the royal family. They were used in harness as well as under saddle. A good many people who have seen the California Lippizans say, "They look more like coach horses than saddle horses." To the American eye, they are too stocky for good saddle-horse conformation. However, they are no heavier nor shorter of leg than many quarter horses.

Later the imperial guard was mounted on Lippizans, and while a number of horses did see actual combat service with various troops on the field and did play a part in the repulse of the Turks, the breed as a whole, always limited in number, became increasingly important for the purpose of royal military show. Guard mount and parade seems to have been their principal function. A new emperor rode an especially trained Lippizan to Coronation Hill to make his pledge of office. It's been said that the horse had to go through a rather more intricate performance than the royal candidate and usually was less inclined to show nervousness.

In 1735, Emperor Leopold I organized the famous "Spanish" riding school at Vienna. This promptly became the center of formal military equitation in Europe. Each year several hundred selected horses were brought from the stud at Lippiza for a complicated course in highschool training and advanced military formations that have never quite been duplicated elsewhere. This involved evolutions to music that is nothing short of a horse ballet.

As commissions in the Austrian army in those days, and most especially in the cavalry, were prerogatives of the nobility and as all officers received at least some of their advanced training at the Spanish riding school, the latter became a center of brilliant social activity for the Vienna court and increasingly so as time passed and every country in Europe adopted the custom of sending selected cavalry officers to the school for advanced instruction. So the Lippizan horses came more and more to represent all the pomp and circumstance of royalty.

Normally none of them were

sold or allowed to be exported but the custom grew up whereby the emperor would present a Lippizan, usually a stallion, to another crowned head to whom he wished to show great favor. There is no record of a private individual being thus honored until the four were presented by the government to Mme. Jeritza, Mr. Sheehan's wife.

After the World War, the partitioning of Austria, the exile of the royal family, and the removal of the stud from Lippiza to Piber, the Spanish riding school passed out with the rest of the royal pomp. It was later revived under Premier Schuschnigg, but the poverty of the ill-fated Austrian republic made necessary a great many curtailments in government expenditures. One of the institutions hit by the economy axe was the training school for singers and musicians and it so happened that Mme. Jeritza, fearful for the future of the art in Austria, gave her salary for singing in the Vienna opera over a period of several years to provide tuitions for a number of promising young singers who otherwise would have had to forego their studies. When she married Mr. Sheehan and came to California she was given what was still considered a most royal gift in recognition of her services to the state.

The horses left Austria late in 1936, in the midst of one of the many political crises, and arrived in California on January 5, 1937, to find the port of Los Angeles closed tighter than a drum by a stevedore strike. The stevedores said that nothing was to leave the ship except the passengers and such handbags as they could carry. The passengers immediately put up a terrific howl about the horses, because the four Lippizans had become universal pets during the long voyage over. "They'll starve," cried the passengers.

"Nothing goes off the ship," said the strikers. "That's orders."

Immediately Mr. Sheehan got in communication with the strike headquarters and told the powers that be a moving story about the gentleness and almost human intelligence of the Lippizans and how keeping them imprisoned on the ship would be almost as bad as locking up four sea-weary children. Strike headquarters became cooperative at once. The horses were led off the ship without further delay.

So the first Lippizans in America were safely conveyed to the Hidden Valley ranch.

The new born colts are black. As yearlings they are what can best be described as "silver tip." The undercoat is still black, but with a grey overcast. I have never seen any two or three-year-olds, but I'm told that they are slate-grey and silver-grey respectively. Four-year-olds are dap-

pled, the dappling fading out to pure white when full maturity is reached towards the end of the fifth year.

The Lippizans never approach albinoism. The skin, nose, and hoofs remain black.

As to size, *Florian* stands sixteen and one-half hands. He weighs twelve hundred and fifty pounds. To the eye he appears both shorter and heavier than these figures indicate.

In 1935, Mr. Sheehan had attended one of the elaborate "horse ballets" at the recently reopened Spanish riding school in Vienna and what with the fact that he had read an English version of Felix Salten's novel "Florian" and his growing enthusiasm for Lippizans after the four were established on his ranch, he decided to make a picture based on Salten's book, covering all the pomp and glory of the cavalry school during the reign of Franz Joseph.

He had no production affiliations at the time, but he went ahead on his own, cleared the copyright situation, had a picture version written, and then signed with Metro-Goldwyn-Mayer to do the picture. While the equine star of this opus was to be the big stallion on his own ranch and the detailed dramatic actions would take place on the MGM lot at Culver City, his plan involved certain scenic and production shots to be taken in Austria, notably at the Piber stud, where there then were about a thousand Lippizans of all ages, and at the Spanish riding school.

To get this material Richard Rosson, camera man and director, was sent abroad in the spring of 1939, armed with official permits to photograph any and all activities at the riding school and the farm. He got the whole elaborate routine of the "horse ballet" the first time it was ever performed before the camera. From what I hear from those who have seen the advanced showing of the picture, it is truly a marvel to behold and very different either from our monkey drill or the usual high school routine in our shows.

Likewise Rosson got some beautiful and spectacular shots of the horses at the Piber stud. But that wasn't enough. He needed a long shot of a typical Austrian town and railroad station for the opening of the picture. Being an American and accustomed to taking his pictures where he found them, he piled his cameras and crew into automobiles and went looking for scenery.

He found exactly what he wanted at a town called Admont, which happens to be an important railroad junction through which all the trains from Yugoslavia and Italy have to pass on the way to Vienna. All of which

was unknown to Rosson, for he knew little of the language and the country. He set up his cameras on a convenient hill and ground away, entirely unaware of the fact that the other hills around were full of hidden fortifications.

The next day he sent an enthusiastic cable to the studio that his shots for the opening of the picture were simply breath-taking.

The next word of Rosson came from the secret police. They had Rosson, his wife, and all of his crew except certain members who were undercover agents of the Gestapo, in various jails, all charged with espionage!

It appears that Rosson had not only taken motion pictures in a highly strategic and heavily fortified military zone, but he had wandered into a province that was entirely outside of the zone covered by his permit.

Every foot of film was seized and developed by the Gestapo. All that it showed was horses, horses, and more horses, and those scenic shots of Admont and its railway station—nothing of any direct military value at all. Still Rosson was kept in jail. He wasn't allowed to communicate with his wife or any of the members of his crew. He was as ignorant of their fate as they were of his. All the information he received from the jailers was that he stood an excellent chance of getting five years in prison for taking pictures in a forbidden zone and ten years more because, they charged, his permits, and passports were forgeries. This last was a fabrication, evidently for no other purpose than to make him feel the more uncomfortable.

It took our State Department thirty-five days to pry the Rossons out of jail. When Rosson came out he weighed ninety-eight pounds, thanks to solitary confinement and an exclusive diet of mush. However, when he was freed, every foot of the film he'd shot was returned to the studio, including the controversial scenics about Admont, and the pick of these appear in the picture "Florian."

So much for the Austrian interlude. Whatever the fate of the Lippizans in their native land, those that are in California have everything that can be imagined in the way of ultra modern stabling and expert attention. The roster of their personal entourage includes a chief-of-staff, a ringmaster, a veterinarian, a farrier, and a mane and tail braider. This last functionary is very important, for the braiding of a Lippizan's mane and tail according to the best precepts of the Spanish riding school is an exacting art and takes long training.

Here the breed will undoubtedly become increasingly important for public display. Their fine

manners, quiet dispositions, intelligence, and easy gait make them perfect show horses—using the term in the broadest sense.

A Trick on Winter Wheat

Condensed from Kansas Farmer

Raymond H. Gilkeson

PLANT winter wheat in the spring and it fails to head out and make a crop. It is an accepted fact that winter wheat, by its very nature, must be sown in the fall, go thru the conditioning of winter, and complete its growth in the spring. But scientists have played a trick on winter wheat. This goes under the name of vernalization—which simply means making it spring-like.

In the process of vernalization the wheat seed is treated with specific temperatures and moisture conditions. In other words, the seed is put through artificial winter conditions. This makes it spring-like as a crop, so when the seed is planted in the spring it grows, heads out and yields well under favorable conditions.

In Canada, experiments have been conducted to determine whether spring-grown winter wheats, which have been vernalized, will outyield spring varieties. Average yields to the acre in 4 tests of Marquis, a spring variety, and Kanred, a winter variety, show that they made 30.4 bushels and 35.2 bushels an acre respectively, according to a report from Ottawa, Ontario. Vernalized winter wheat did better than spring wheat. Milling qualities of the hard red winter wheat proved satisfactory, when the vernalized wheat was grown in the spring.

Reprinted by permission from the Kansas Farmer, Topeka, Kansas, July 27, 1940

Acetonemia

Condensed from Holstein-Friesian World

Dr. Jesse Sampson

University of Illinois

IMPORTANCE: Clinical ketosis is now recognized by veterinarians as a common disorder of great economic importance to the farmer who owns a herd of high producing cows or the farmer who owns a flock of breeding ewes. The dairyman oftentimes encounters the malady in his more valuable cows as the disorder called acetonemia; the flock owner oftentimes encounters it in from 25 to 50 per cent of the pregnant ewes as the disorder known as pregnancy disease. The pathological physiology involved seems to be fundamentally the same for both of these disorders. This phase of the subject will not be considered, however, and I shall furthermore limit the discussion to acetonemia in cows.

Acetonemia occurs primarily in cows that belong to the dairy type. Cows of all ages and of all breeds are susceptible and may suffer repeated attacks. The disorder may develop during the latter part of pregnancy, but is observed most often any time during the first to the sixth week after calving. The highest producing cows are most likely to develop the malady; hence, it is usually the more valuable animals in the herd that are affected.

Cause: Acetonemia is not a communicable disease. The direct cause is believed to be a disturbance of the carbohydrate-fat metabolism within the body and indirectly to an inadequate consumption of carbohydrates or carbohydrate-forming food. Corn and oats are examples of feeds rich in carbohydrates. An inadequate consumption of carbohydrates may result from:

1. Too small a feed allowance, especially of grain for the pounds of milk produced. This seems to be the cause in the great majority of cases.

2. Too rapid and too great a reduction in the concentrates of the ration fed during the last few weeks of pregnancy and the first week after calving. There is an urgent demand for sugar (carbohydrate) during the late stage of pregnancy and at the onset of lactation. The calf requires a liberal supply of sugar before as

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well as after birth. Following parturition there must be a reserve of carbohydrate to supply the sugar that is put into the milk. It is the sugar carried in the blood of the cow that presumably supplies the major portions of these demands. Animals can store only a limited amount of readily available carbohydrate in the body. Any unusual demand for sugar must, therefore, be met by the carbohydrates or carbohydrate-forming food contained in the daily ration. If this supply is cut off or reduced beyond a certain point, some cows in advanced pregnancy and many more after calving are likely to develop acetonemia.

3. A third cause for inadequate consumption of carbohydrate or potential carbohydrate is an impaired appetite. Partial or complete loss of appetite may be associated with indigestion and other disorders such as retained placenta and metritis. Close confinement with lack of exercise may also dull the appetite of some high producing cows. These cows may continue to produce fairly well and develop ketosis. Production usually takes a rapid fall when this stage is reached.

Diagnosis: One of the accepted qualitative methods for the detection of abnormal amounts of the ketone bodies in the urine may be employed in establishing a diagnosis of acetonemia. Dr. C. E. Hayden recommended the Ross modification of Rothera's nitroprusside method and this test has become popular with many veterinarians. All of the veterinary supply companies have the essential reagents listed in their catalogs and supply the necessary directions. This test is simple, rapid, and accurate. In severe cases of acetonemia the milk, as well as the urine, gives a positive test for the ketone substances; the reaction, of course, is very much more pronounced with urine than the milk.

Symptoms: It has been our observation that acetonemia occurs most often as an independent disorder, but attention should be called to the point that it may be found to be associated with milk fever and metritis, and occasionally with other diseases. The listless, lethargic type is seen far more frequently than the nervous form of the disorder.

In general, it can be said that there is no specific group of symptoms for acetonemia, but in nearly all cases there is a sharp decrease in milk flow, partial or complete loss of appetite, and rapid loss of condition. Constipation is frequently associated with the disorder. Since this disease may be confused with forage poisoning, indigestion, milk fever, metritis, encephalitis, and even with rabies, the diagnosis and initial treatment should be re-

sponsibilities of a competent veterinarian.

Treatment: Intravenous and subcutaneous injections of dextrose solution are the safest and probably the most effective forms of treatment. Chloral hydrate per orum is used with favorable results, but fatalities may occur if caution is not exercised in the selection of the cases treated in this manner and the dosage administered.

It is not an uncommon occurrence to encounter typical cases of acetonemia that fail to show rapid improvement from injections of dextrose solution or from chloral therapy. Observations made at this laboratory indicate that such cases will usually show a prompt and favorable response when the injections of dextrose solution are supplemented by the daily oral administration (by drench, stomach tube, or with the feed if the animal will eat) of from 2 to 4 pounds of an inexpensive grade of corn sugar or ordinary black strap molasses. It has been found convenient to divide the sugar or molasses into several doses and administer each dose well diluted with water. This treatment may be repeated for three to four days or longer depending on the intensity of the ketosis.

Prevention: Some cows apparently develop ketosis more readily than others. These animals must, therefore, be given more feed, preferably in the form of concentrates, than is prescribed by rule of thumb feeding practices if they are to escape an attack of acetonemia. Cows that are known to have had attacks of ketosis can be fed advantageously the usual ration of roughage and grain and in addition from 2 to 4 pounds daily of an inexpensive grade of corn sugar (dextrose) or ordinary black strap molasses during the last few weeks of pregnancy and the first three to six weeks of the lactation period. It is usually not a difficult task to induce cows to consume either of these supplements if the increase in the amount fed is not made too abruptly.

When the herd has access to luxuriant pasture it does not seem to be so essential that these supplements be included.

A Sheep Plan That Works

Condensed from Farm Journal and Farmer's Wife

Richard C. Miller

EVERY year delegations from many states come to Kentucky to learn about a sheep program which in some respects has run directly counter to the teachings of instructors and writers of farm sheep husbandry. Buying our breeding ewes instead of raising them (by saving back ewe lambs) is a phase of the program that has attracted most attention nationally.

In the early '20s, sheep growers in the Bluegrass State found they were facing a major problem—breeding ewes. The supply of Kentucky and Tennessee mountain ewes, which many Central Kentucky lamb producers depended upon, was being rapidly depleted and the quality getting poorer year by year. This was a result of trying to "breed them up" through crossing with rams of the Down breeds. Plainly, the efforts of farmers to produce their own ewes were not working out.

Not only was the number of ewes in farm flocks decreasing, but it was also becoming more difficult to get lambs ready for market early in the season before stomach worms and hot weather had slowed up their growth.

Search for a plan better suited to our conditions and purposes here in the Bluegrass included most of the important sheep producing areas abroad. It was in New Zealand that the writer found a system which, with certain variations, offered promise of success. New Zealand, like Kentucky, caters to a quality lamb for a special trade.

Most lamb producers there purchase their crossbred ewes from areas more suited to raising ewes than lambs, and mate these ewes with Down rams (mostly Southdowns) to produce their famous Canterbury lambs.

This plan of making ewe replacements and building new flocks through the purchase of young ewes from the range states (mostly the Northwest) has worked out so well that Kentucky now has about three times as many sheep as each of a number of neighboring states which formerly had about as many as Kentucky. One of these states, Tennessee, is now building her program on the basis of Kentucky's experience.

This ewe program has in fact saved our sheep industry, made

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possible earlier and better lambs, added millions of pounds to the annual wool clip, stimulated the re-establishment of the industry in sections of the State where it had all but disappeared. More than half the breeding ewes in Kentucky are now of western type, about 350,000 of which have been brought in during the past two years.

The acceptance of this plan by sheep growers is not because of sentiment, but of dollars. Accumulated experience of thousands of Kentucky farmers is convincing evidence that when a yearling western ewe of a type suited to our conditions can be had for about the price of a choice 80- or 85-pound ewe lamb, it does not pay to save the lamb over, fight stomach worms through two summers and feed her through a winter before she is ready to breed.

Furthermore, if this lamb is out of a ewe typical of most types of natives of this area and sired by a ram of the type most popular in our system of lamb production, the ewe would generally be a comparatively late breeder, a light shearer and most likely deficient in milking qualities. On the other hand the western ewes breed earlier, are generally free from stomach worms, are much hardier than natives, last from one to three years longer and yield several pounds more wool, on the average, than native ewes obtained by saving back our ewe lambs.

In general, the experience of Kentuckians shows that the Hampshire-cross western ewes produce lambs of higher quality than ewes of any other western type. In fact, most of the strictly prime lambs marketed from Kentucky are out of ewes of this type and by Southdown rams. They are also fair wool producers, though not equal in this respect to white-face crosses. An average annual clip of from eight to ten pounds can be expected from good well-fed western Hampshire-cross ewes.

You know this plan is taking hold in the Bluegrass when you consider that normally, fully 80% of the Hampshire-cross ewe lambs grown out to yearlings in the West come to Kentucky. Shipments usually begin early in July and continue through August. These lambs come in after the nights get cool and the danger of stomach worms is largely passed. The wool clip normally will pay cost of feed, pasture and labor in carrying them through to yearlings.

While ewes are purchased through all the dealer channels in operation elsewhere, there is also in operation in Kentucky a co-operative plan by which ewes are bought on a county or community basis. This enables farmers who

may need only 25 or 30 ewes to get them in car lots at so much per head delivered to their unloading center. This plan reduces cost to the minimum, and also keeps the farmer from getting ewes of the wrong kind from speculators. More than 100,000 ewes have been handled on this co-op plan during the past few years.

Regardless of section or size of flock, the more successful lamb producers now plan to have most of their lambs on the market by early July. The early lamb gets the advantage of cool nights and grazing when the grass is young, tender and most nutritious. By marketing in May and June, the dangers of internal parasites are avoided and the market price per pound is usually higher.

Lambs Come in January

Handling the ewes and lambs to hit this early market is in itself a real sheep story. Ewes are put on sparse pasture at weaning time and kept there to within a week or two of the breeding season, then given the best pasture available. For early lambs, rams are turned with the ewes between August 15 and September 10. Owing to hot weather during the breeding season, the number of ewes to each ram is lower than is the case in some other areas. One ram to every 25 or 30 ewes is the usual ratio where rams are left with the ewes all during the breeding season. Operators who pull the rams out during the day, feed them some grain and allow them with the ewes only at night, or an hour or two during the early and late afternoon, get by with fewer rams.

Fall and Winter Pasture

Normally flocks are handled on pasture throughout the entire year. Bluegrass, stubble fields and lespedeza usually suffice without use of harvested feeds until December. Winter pasture is usually wheat, rye, barley, or bluegrass that has been allowed to make good growth during fall by keeping stock off of it. This grazing is supplemented with hay a month or six weeks before lambing. Grain is usually started about two or three weeks before lambing. Most farmers depend almost entirely on legume hays (lespedeza in more cases than not) for roughage. Corn is the grain if roughage is entirely good legume hay. If hay is poor, corn is supplemented with a protein supplement, such as linseed oil meal, cottonseed meal or soybean oil meal. Oats and bran are used to some extent.

Most flocks are lambed out during the winter season. This calls for housing at lambing time —usually the tobacco barn, for nearly every Kentucky farmer has one or more. Tobacco has been sold, as a rule, by the time sheep need the barn. Successful

farmers generally use individual lambing pens for the ewe and her lamb to go to immediately after lambing.

After lambs are a day or two old and all is well, ewes and lambs leave the barn for a field or paddock close by, later to be moved back on rye, wheat, barley or other pasture. Creep feeding, while by no means general, is practiced by many of the best early lamb producers from the time the lambs will eat until plenty of grazing is available.

The practice of numbering the ewes, which is becoming increasingly popular, makes possible individual production records, provides a basis for culling, and simplifies management problems. When a ewe lambs, her number is put on her lamb or lambs before they leave the lambing pen.

Marketing normally gets well under way in May and the lambs are marketed off their mothers. Farmers like to make their lambs weigh 80 to 85 pounds. Because good markets are close at hand, with keen packer competition for lambs of high quality, lambs are sent to market only as they are ready to go. In the larger flocks a pulling may be made every two or three weeks, sometimes oftener.

The Parasite Problem

Because of the danger of bringing parasites (stomach worms, particularly) into the flock with animals brought in, most Kentucky farmers now prefer to buy their rams in the barn lot of the man who produces them—and then only after seeing the ewe flock and particularly the lambs. Many of the operators quarantine these rams for a couple of weeks and treat them twice for worms before they are turned with the ewes. Most of the more successful operators treat their ewes monthly from May to October. Lambs not ready for market by early July are usually given their first treatment in late May or early June.

Some farmers shear these late lambs, carry them over and finish them in fall. In fall they can be grown out at comparatively little cost on lespedeza and other fall pastures and marketed at heavier weights than would be practical during summer. Sheared out lambs hold their condition much better during hot weather and make faster gains in fall than lambs carried through with wool on.

Rubber Tires Versus Steel Wheels

Condensed from American Fruit Grower

Dean Halliday

WHEN the wheel was invented some 4,000 years ago it literally revolutionizeds man's labor in the fields.

When, in recent years, the pneumatic rubber tire began replacing steel on the wheels of farm equipment it also literally revolutionized work on the farm.

In the case of the fruit farm the introduction of rubber tires has not only made orchard operations roll easier, but it is actually leading to a mechanization and modernization of the fruit farm that was scarcely dreamed of less than a score of years ago.

Scientific studies of rubber versus steel on the wheels of agriculture have been undertaken only comparatively recently, but already such studies show the following definite advantages when pneumatic tires are used:

Greater speeds possible, both for tractors and implements.

Reduction of rolling resistance by almost half.

Longer life for the machines, the result of cushioning against the wear and tear of vibration.

Greater drawbar pull and less fuel consumption.

Rubber has proved to be a prime first aid for the fruit farmer because so many of his operations must be done against a time schedule regardless of field conditions and weather. Speed of operation often means the difference between profit and loss.

During the winter and in early spring the fruit grower must be "on the land"—and working—no matter how rough, soggy or slippery the soil. Heavily loaded spray tanks must be hauled up hill and down dale, for orchards quite generally are planted on hill slopes. Modern tractors have the power to haul such deadweight loads, the heaviest encountered in any type of farming. And rubber tires, so the engineers find, on the wheels of a sprayer or other heavy equipment, reduce rolling resistance to such an extent that the hauling actually becomes comparatively easy even over land so soft and muddy that steel wheels would bog down in it.

At Ames, Iowa, Eugene G. McKibben, associate professor of agricultural engineering, and J. Brownlee Davidson, professor and head of the Department of Agricultural Engineering, Iowa State College, recently deter-

Reprinted by permission from the American Fruit Grower, Cleveland, Ohio, June, 1940

mined to find out if rubber-tired wheels on agricultural machines actually do roll easier than steel wheels.

In making their studies they put 23 wheels through a series of rolling resistance tests. Six of these wheels were steel and 17 were pneumatic tires. The wheels varied in width and diameter from 25 x 36 inches to 12.75-32 inches. The wheels were tested at several loads under four operating conditions, including concrete, bluegrass pasture, tilled loam and loose sand.

The tests revealed a number of things to Doctors McKibben and Davidson which have to do with co-efficients of rolling resistance compound curves and other extremely important engineering data.

The net of these experiments, however, from the standpoint of the fruit farmer who must do heavy hauling over this land under any and all conditions was that "the mean reduction in rolling resistance resulting from the use of pneumatic tires was 28 per cent . . . " and " . . . on rough surfaces or soil where the supporting strength of the soil approached the inflation pressure of the tire, such as a field road across fall plowing, they reduced the rolling resistance by 46 per cent."

Increased speeds and reduced rolling resistance made possible by rubber tires are important to the fruit grower, but so is the life expectancy of his various pieces of expensive equipment.

Here again rubber is a first aid. The vibration of steel-wheeled equipment wracks and soon wrecks it, or makes costly repairs necessary. Rubber tires applied to similar equipment smooth out much of the shake produced with steel wheels. Comparative vibration tests made in Indiana have proved this.

R. B. Gray, chief, Division of Mechanical Equipment, Bureau of Agricultural Engineering, U.S. D.A., is authority for the statement that some engineers claim that the life of rubber-tired farm equipment should be increased around 25 per cent over that of steel-tired equipment.

The fruit grower, like any other farm operator, wants hauling power at the lowest possible cost in fuel consumption, and here again rubber tires come to his assistance. Tests reported to the American Society of Agricultural Engineers show that fuel consumption is 5 to 15 or 20 per cent less for tractors equipped with rubber tires than it is for those with steel wheels, depending upon conditions.

Gray points out that one large sprayer manufacturer, in cooperation with a state agricultural college, reports interesting draft test figures with a four-wheel sprayer weighing 6055 pounds

loaded, using different sizes of of pneumatic tires and different widths of steel tires under different soil conditions.

In cultivated loose sandy soil the draft was 1210 pounds when using steel wheels 28 x 5 (front) and 54 x 5 (rear). By increasing the width of the rear tires from five to eight inches, other sizes remaining the same, the draft was reduced to 975 pounds—a reduction of 235 pounds because of three-inch wider rims on the rear. By using pneumatics, 5.00-17 (front) and 6.00-20 (rear), the draft was reduced to 750 pounds, and by changing the rear from 6.00-20 to 7.00-17, front tires remaining the same, the draft was reduced 20 pounds more, to 730 pounds.

Using the same wheel equipment on firm alfalfa sod, the steel wheels with five-inch face on rear gave 825 pounds draft and when increased in width to eight inches gave a 750-pound draft—a reduction of 75 pounds or 25 pounds per inch of extra width. By using pneumatics the draft was reduced to 485 pounds, the same for both sizes.

In selecting tires for sprayer service, Gray advises that the sprayer manufacturers' recommendations should be adhered to or those of the Tire and Rim Association which gives the tire and rim sizes, air pressures, etc., for safe loadings.

One large sprayer manufacturer, Gray states, reported that some 65 per cent of his sprayers were mounted on rubber tires in 1938, and that nearly 80 per cent were so mounted in 1939.

Changing to Rubber

B. A. Jennings
Cornell University

STEEL wheels can be fitted with rubber tires by removing the steel tire and welding a drop center rim to the spokes of the steel wheel. Drop center rims are on the market purposely for this job.

The steel rim is removed by cutting off the spokes the correct length on a jig. The jig also holds the new rim in the correct position for welding.

Tire sizes are designated by two numbers. The first number indicates the cross section of width of the tire and the second indicates the diameter of the rim. For example, a 6.00-20 tire has a cross section or width of 6 inches and is for a 20-inch rim.

To determine the size of tire to use, take the diameter of the original wheel and subtract twice the cross section width of the tire to be used. The cross sectional width of the tire should be the same as the width of the steel wheel. For example, a steel wheel 42 inches high by 8 inches wide, should be equipped with a 7.50 or a 9.00 tire. If a 9.00 tire is used, multiply 9 by 2 equals 18 inches, and subtract this from the diameter of the wheel, as 42 inches minus 18 equals 24 inches for the rim size. Therefore, the tire size would be 9.00 by 24. If a steel wheel is 28 by 4 inches, a 5.50 by 16 rim and tire can be used.

Outdoor Brooding in the Rain

EVERY now and then we hear of some poultryman who has set up an electric brooder out in the yard on the grass, and, to everyone's surprise, raised a good brood of chicks. Recently we learned of another one. Mr. O. R. Maynard lives out from Coudersport, Pa. Don't tell the Chamber of Commerce, but it is reported that they have 11 months winter and one month cold weather up there. It's too cold to raise corn.

Last spring, Mr. Maynard, using a standard galvanized iron brooder with a fan, started 275 chicks in a 500 chick size brooder, placing it on his lawn with no cover over the brooder. On the third day it rained and the chicks got wet when they came out to feed. The chicks did not mind the rain and showed no bad after effects. A 90 degree temperature was held easily under the brooder which was moved every second day to a fresh location. Up to the time the chicks were 3½ weeks old, and when this information was obtained, only five chicks had been lost, and that in spite of the cold, rainy spring.

The electricity used for operating the brooder is probably somewhat greater for outdoor operation than in a building. Mr. Maynard was so well pleased, however, that he says he would be willing to pay three times the normal operating cost in order to have the advantages of outdoor brooding. He says these are the best chicks he has ever raised.

—*Electricity on the Farm*

Culling Pays Dividends

Condensed from American Poultry Journal

Edw. A. Morrison

CULLING gets rid of low vitality and diseased birds of all ages, thus helping to prevent the spread of disease and parasites; it increases the average quality of the remaining birds, thus helping to boost average production, and it reduces feed costs, which helps to increase profits. Culling is an aid in selecting the best birds for breeders, for contests, or to be held over for another year. It also enables us to segregate the birds into groups of like individuals so that there will be more even development and less competition between the early and late maturing birds.

Every poultryman knows what the good layer looks like. She has good body size, a full, red comb, bleached shanks, and a soft pliable abdomen with pubic bones spread apart so that there is room for 3 fingers between them and 4 finger widths between the pubic bones and the end of the keel.

Poultrymen have associated loss of pigment, also, with production for a good many years; past production performance can be rather accurately gauged by means of the definite order of disappearance of the pigment from different parts of the body.

It must not be assumed that there is a definite line or division in the order of bleaching of the various parts. The truth is that all parts begin bleaching at the same time, but, due to the texture and thickness of the scales and skin of the various parts of the body, some of the parts become entirely bleached, while there is little noticeable change in color of the other parts. It is said that 6 eggs will bleach the vent, 10 to 15 will bleach the eyering and earlobes, and 30 to 40 will bleach the beak entirely white.

To bleach the various parts of the legs the following number of eggs has been found to be about average: bottoms of feet, 68; front of shanks, 96; rear of shanks, 160; tops of toes, 175; hock joints, 180. From this it may be gathered that a more or less definite period of time is required for the bleaching of the different parts, depending on the persistency of production. It is said that a noticeable degree of bleaching will be seen in the vent in 10 days, eyering and earlobes in 2 weeks, beak 6 weeks, and shanks 3 months.

Pigment returns to the parts in the same order in which it left it, but in about half the time. How-

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ever, the color remains the longest in the hock joint and tops of the toes.

An important criteria in production judging that can be used in conjunction with pigmentation is the molt. Time of molt is generally a good index of production value, inasmuch as the poor layer stops laying and molts in July, August, or early September, while the better layer will continue to produce and will not molt until October or November. However, molting is influenced by the physical condition of the bird and the feeding and management, so the time of molt should therefore not be used as an index for judging unless the birds are in good condition and have been fed and managed properly. Also, it should not be used in the case of early hatched pullets that have come into production and then have molted. This is normal and they will come into production again during the winter.

Birds can lay and molt at the same time, but only if they are maintaining or increasing their body weight. This stresses the importance of proper grain feeding, for it's the grain that helps keep up weight. Birds that continue to lay while molting are counted as the most efficient egg producers and are much preferred to birds that cease laying at the beginning of the molt.

Before culling all early molters, there is one point that must be recognized and that is the fact that the bird that molts early but continues to lay through the molt is just as good a bird as the late molter. She should not be discarded simply because she is molting.

Inasmuch as most birds go out of production during the molt, it is obvious that the bird that molts rapidly is comparatively better than the slow molter. One of the best measures of speed of molting is the relative length of the growing primary flight feathers of the wing. It requires approximately 6 weeks to renew a primary feather.

If the difference in length between several adjacent growing primaries is small, and if the bird is apparently renewing several primaries at one time, she is a rapid molter and is a better producer than one having distinct differences between successive primaries. In other words, it requires 6 weeks to renew 3 feathers that are shed at the same time. If they were dropped a week apart, it will take 8 weeks to renew them. A bird should not be discarded because she molts late in the fall, even when compared to the bird that lays and molts at the same time.

The rate of body molt is also a reliable aid in selecting the best layers. The poor layer will usually drop only a few feathers at a

time so that she seldom shows any bare spots, while the good layer often sheds most of her feathers at once, leaving her body practically bare. This is probably due to the fact that the eggs have been using most of the material required to make feathers. Finally, when the majority of the feathers are suddenly lost, the bird goes out of production. The energy that went to support her heavy production then is used to grow feathers, with the result that she has a new crop of feathers and is ready to lay again in record time. Thus, the best bird is the one that molts late and then does a quick job of it.

Experienced poultrymen will tell you that the best layers have full, bright eyes and a "rugged-refined" head, are active, and generally have rough, ragged feathers from spending a lot of time on the nest and because the drain on the feathers causes them to become brittle and frequently to break off, particularly around the head. They also say they can tell by the shape, though a great deal of shape variation will be found among high producers.

It is true that high producing birds are thought to possess certain identifying characteristics. The heavy laying type is said to have a long, broad, flat back that carries its width well past the hips so that it does not pinch off too much at the tail. Good depth of body and length of keel are also desirable, inasmuch as a large, deep body is believed to indicate plenty of capacity for production.

A good layer has a large, soft, pliable abdomen with a large moist vent, while the poor layer has a small hard abdomen and thick, coarse skin as compared to the thin pliable skin of the layer. The shanks of the good layer are lean, flat, and have fairly fine scales in contrast to those of the poor producer whose shanks are fat, round, and coarsely scaled. At the end of a heavy laying season the skin of a high producer will frequently be found to be dry and the feathers brittle, sometimes to the extent that certain areas lose their feathers.

Also, the good layer has fine flexible pin or pubic bones that curve inward slightly. There is 2 or 3 fingerwidths' space between them, while the poor layer has blunt, coarse, unyielding bones that lie close together. There should also be about 4 fingerwidths between the pin bones and the keel in a good bird.

Good layers are gentle and do not object to being handled, except when molting. They are alert, active, and are always at the feed hoppers.

By systematic and continual culling, the poultryman can maintain production and returns at a maximum.

They're Hard on the Rustlers

Condensed from The Farmer

William H. Kircher

RUSTLING had become a highly profitable business in western South Dakota before stockmen got their dander up. A good ex-cowboy with a truck, a questionable sort of courage and no conscience could make out nicely for himself in the rustling business. If he hooked up with a good partner or two he could pick up 40 or 50 head of cattle or horses every two or three weeks. Then he could move his loot to market, get his check and soon have enough money to set himself up in an honest business if he was so inclined, which he seldom was.

But stockmen never had a reputation for being long-suffering when rustling was involved. To them a horse thief is a horse thief whether he moves by truck or straddles a cow pony so they set out to make life miserable for rustlers. To accomplish this, two laws were passed at recent sessions of the state legislature, one of them compelling both stockmen and truckers to submit their loads to inspection before moving to market, and the other to mark both hide and meat of slaughtered cattle sold by stockmen to butcher shops, hotels and restaurants.

There has been considerable resistance to the truck inspection law east of the Missouri River, and a little of it in the West River country because of the inconvenience of having loads inspected and also because of the 10 cents per head inspection fee. However, there are many stockmen who do like both laws, and Fred J. Searls, chief agent of the Bureau of Investigation and Identification of the State Attorney General's Office, can show that since the laws were put into effect there has been a tremendous drop in numbers of livestock rustled.

Much of this rustling trouble had its beginning with the coming of good highways and fast trucks. Thieves could load up, cross a couple of state lines and sell their loads to unsuspecting buyers 400 or 500 miles away, and get the whole job done in 24 hours or less. More often, however, they would steal a load, haul it to some ranch or farm 75 or 100 miles away, leave it there for a week or two until the "heat was off," and then move it to market.

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Under the load inspection law the hauler, whether he is owner of the livestock or a custom trucker, must call the nearest sheriff's office before starting out with his load and arrange for inspection there. The inspection consists of the hauler identifying himself and the origin of the livestock and going on his way with an inspection slip. Of course, there are instances of violation of this law, but the State Bureau is urging all livestock buyers, whether they be packers, operators of sales pavilions or whosoever they may be to demand inspection sheets, bills of sale or other identification of the man and his load before buying.

The law aimed at the rustler who slaughters his loot before selling also is proving effective. Under the old law, the seller was forced to keep the hide of a slaughtered animal 10 days after selling the meat so that it would be available for brand identification if some question arose as to ownership.

"Some of those hides covered a lot of animals," said Agent Short. "Often we'd find that a rustler had killed one steer that he could identify as being his own, and then on the basis of having that hide go out and kill seven or eight more during the 10-day period."

The present law provides that a hole one inch square be cut in the hide at the tail head and that the meat be branded with the number designated for the county from which it comes, and the number of the inspector who branded it. These numbers are registered with the state, making it relatively easy to trace a piece of meat to its origin.

Working in cooperation with law enforcement agents are men in the laboratory of the Investigation and Identification Bureau. This laboratory is equipped with all the modern devices for trapping criminals. When we entered the laboratory, Lester De. Price, the agent in charge, was bent over a double microscope comparing two .22 caliber bullets. One of these bullets had been taken from the head of a steer shot on range west of Chamberlain. The other was from a rifle owned by a man suspected of having shot the steer, butchering it and selling the meat.

"This is one of the best tools we have in the laboratory," said Agent Price. "Since we've installed it, it has helped clear up several cases involving slaughtering and butchering. We boast that our laboratory is the best between Chicago and Denver."

As you talk with law enforcement people, and with ranchers, you come to the conclusion that rustling is becoming less and less healthy, and rustlers seem to be reaching the same conclusion.

Where Building Faults Show Up

Condensed from Missouri Ruralist

Cordell Tindall

ANY building erected on the farm should be constructed so that it will prove a good investment. It should give long years of efficient service. Just how efficient the service will prove to be depends upon the use and the plan of the building, which differ greatly on various farms.

The number of years a building will last, whether it be only a small chicken house or a large home, will depend a great deal on several features of its construction. In planning any building it is well to consider those features that add to the life and service of it.

J. C. Wooley, head of the agricultural engineering department of the Missouri College of Agriculture, made a study, or survey, several years ago on farm buildings in two North Missouri Counties. The results of this survey, published in Research Bulletin 218, plainly show what we should consider in adding years to buildings.

He found that foundations, sills and connecting framing are the most frequent locations of failure in buildings. These are the danger spots, where we are most likely to find errors in construction.

Most often it was the sills that gave first trouble. Biggest reasons for this was lack of roof and yard drainage. Nothing wears the sills of a building out more than the splattering of mud that results from absence of gutters on a building.

Mr. Wooley's survey indicated that putting spouting on a building increases its life by 41 per cent. When putting hundreds of dollars in a building that you hope to see stand the rest of your lifetime at least, it is false economy to neglect spending a little additional money for gutters.

Lack of roof drainage means rotted sills, framework and siding. A large amount of water drains from roofs and in dripping onto the ground splashes up on the siding, carrying some soil with it.

If the wind is blowing, the water from the roof is dashed against the siding and in most cases finds its way thru to rot sills and girts. The water rushing down from the roof may also carry away the soil from around the foundation, leaving footings exposed and may even cause large foundations to settle.

The next vulnerable spot on

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buildings is the foundation. Often they are built too low. Others are too shallow to be safe from erosion and lack of drainage.

Again, the survey showed that foundations more than 8 inches high increased the life of buildings 43 per cent. In years, this added 14 years to the life of buildings studied.

Even good foundations are ruined thru lack of drainage or thru erosion where water is not properly handled.

Paint is not just to make a building attractive. Painting a building when it is completed adds more than 8 years to its life, Mr. Wooley's survey indicated. When painted as needed an average of 16 years more service is possible.

Figuring the cost of paint at $7 a gallon, it was found that the first painting returned an interest of more than 3.75 per cent on the investment. Later paintings, as needed, also returned interest of around 3.22 per cent.

A popular trend in building barns now is to use stone, or other such material, for the side walls up to eaves of the roof. This practice not only cuts cost but makes a very serviceable barn. In a livestock barn, especially, the side walls are often damaged by the stock, by wagons or manure spreaders in cleaning out the barn, or by other such unavoidable causes. A stone wall "can take it," giving years of service.

A solid wall also provides a substantial support for doors and gates in a barn. About the first thing that happens in a barn is for the gates to begin to sag, then pull their supports over.

Because of the fire hazard, most of the newer barns have metal roofs, with some of various kinds of fire-proof roofing paper. In fact, more and more buildings constructed entirely of metal are found over the state. Where large amount of feed or valuable animals are housed this added fire protection is proving popular.

We hear a lot about insulating these days, and farm people are quick to follow any new trend. Kenneth Huff, extension building expert, has some good ideas about making a house warmer in the winter.

First thing to do is to stop the wind from finding cracks and entering the house, Storm windows and storm sashes will prove a good investment for comfort and save fuel. Storm windows that fit into the original frames are satisfactory.

After the cracks are stopped the best place to begin insulating is in the ceiling, believes Mr. Huff. Insulation of the walls will do a lot of good, too, but should come after ceiling is covered over with some good type of insulation material.

Keeping Records

John A. Hopkins
Asso. Prof. Agricultural Economics, Iowa State College

THE principal purposes of farm records may be grouped under three general headings. In the first place they give a history of the performance of the farm for the period during which they have been kept. At intervals statements of the value and status of the business are obtained. These not only show the farmer where he stands financially at the time, but at later dates permit him to appraise the progress which he had made between inventory dates. The records of receipts and expenditures, of crop yields, livestock production, feed and other consumption help explain the results obtained.

A second objective is to provide an aid to the control of the current farm operations. One needs to give close attention to current records to tell how well the business is conforming to plans or budgets that were set up for it. This does not refer merely to the financial plans but also to physical or technological efficiency. It is important that any unsatisfactory performance be detected promptly if it is to be remedied before more serious losses occur.

A third objective is to provide the basic information needed in the budget or production plans. If the budget is to be practically useful, it must reflect accurately the productive potentialities of the farm for which it is drawn. The records will give the needed information on crop yields, rates of gain obtained on livestock, butterfat production per cow, eggs per hen and other figures of this type. They will also show the actual amounts of receipts and expenses. Without such figures as these it is necessary to fall back on estimates which may be quite inaccurate.

It is important that we be able to record the significant facts with a minimum of effort and without omitting or obscuring important information. This has to do with the technique or the mechanics of bookkeeping. A distinction between the accountant and the bookkeeper is often made by saying that the function of the accountant is to design the records and develop the method by which they are to be analyzed, while the bookkeeper simply performs the mechanical work of recording transactions, posting and summarizing.

In the small business, such as

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the farm, the accountant and bookkeeper will necessarily be the same person. Furthermore, he will not only record and summarize the data but will also interpret and use them.

Different Farmers Have Different Problems

The question "What information does the farmer want?" is always an important one. No two men approach the problem of management from exactly the same angle. It is obvious that the forms of accounts should vary to suit the business rather than be the same on all farms. This is another reason for placing emphasis on methods rather than on forms. With an understanding of the methods, suitable forms for the problems at hand may generally be devised without much trouble. Without this understanding, even the most convenient forms cannot be used to advantage.

Once the system of accounts is fitted to the farm, keeping the records currently is relatively easy. Putting down the figures and adding them up is simply a matter of routine. It is the process of analysis that involves the greatest trouble. To obtain any benefit from the figures it is necessary to watch them and study them almost continuously. This takes real mental effort, and to the great majority of people that is much harder than physical work.

Specific Purposes of Records—Stages of Completeness

Comparative Inventories

There are several stages to which one may go in keeping records for a farm. The simplest possible form of records would be an inventory taken once a year. This is simply an enumeration of assets and liabilities. It is usually taken on the corresponding dates each year. It shows the financial status of the business and the relative importance of the various properties and debts.

The usefulness of the annual inventory is very limited, but by comparing inventories in succeeding years the farmer can usually get a fairly good idea of the progress of the farm as a whole. A comparison of inventories will show the growth or increase in the capital from year to year and the distribution of this capital among the various types of property. This gives a sort of cross-section of the business at that particular time. It shows how much of the capital is in the form of land, how much in equipment, horses, cattle and cash.

If the net capital is found to be larger than at the corresponding date a year before, it is an evidence of success or growth of the business. But it does not tell the whole story. It leaves unanswered questions of why the success, or of which factors contributed to the profitable out-

come. Neither does it tell the amount of the profit for the year. For instance, a comparison of inventories shows an increase in capital of $1,000. But it may be that the total profit was $2,500 and that $1,500 was withdrawn from the business by the proprietor during the course of the year and spent for his personal living expenses. Inventories give no explanation of what happened within the business between dates.

Records of Financial Transactions

The second stage in completeness of records is attained by adding a record of financial transactions. This means that some sort of journal or book of original entry will be needed in which to record receipts or expenditures as they occur, and also a ledger in which these may be classified with regard to functional divisions of the business. Accounts will also be kept with persons outside of the farm business with whom there are transactions on credit.

From the financial accounts may be discovered the amounts of receipts during the year from each enterprise and the expenses for each purpose. A record may also be obtained of the personal withdrawals from the business and the investment of new funds from outside sources. From the detailed accounts of receipts and expenses the farmer may get an idea of the success obtained in some few of the functions of management. But this will be inexact.

On the one hand, the amounts of expense incurred give a very poor idea of the economy with which many of the cost factors are used. On the other hand, the volume of income is usually a very inadequate measure of the suitability of an enterprise to the farm organization in question.

Statistical Records

A third step is to add to the financial records just discussed such supplementary, statistical records as feed records, labor records and records of yields of crops or livestock products. These may prove fully as useful as the financial records. They indicate whether the technical performance in various enterprises is up to a satisfactory standard.

Is the feed consumption excessive as compared with the physical output of pork, beef or butterfat? Is too much labor or power being spent on various operations? Records of yields in different fields over a period of years may give valuable clues to needed soil treatment, as well as forming the basis for possible changes in cropping systems. Like the financial data, these physical measures must be interpreted in view of the specific conditions under which the particular farm operates. They are generally quite as

useful as the financial records, and the information they yield as indispensable in any worth-while budgeting or planning.

Again, the records must be fitted to the particular situation in which they are to be used. Like other instruments, accounts must be judged by the results they help to achieve; and it must be remembered that diminishing returns appear in farm records as well as on other enterprises. The more complete and accurate the records the greater the trouble involved in keeping and summarizing them. After a certain point this trouble is likely to increase faster than the benefits obtained. Careful planning and good judgment are as much needed here as in any other phase of management.

Relationships Between Budgets and Records

The concept of a general budget or plan has, in a large measure, grown up independently of the records. The records also have often been treated without regard to the budget. As a matter of fact, records and budget are parts of the same system. Neither can achieve its greatest usefulness without leaning heavily upon the other.

The organization of budget and records must be parallel. Each section of the budget is a plan for a definite part of the business. To measure the degree to which that plan is attained it is necessary to set up a corresponding account for its financial aspects and, frequently, statistical records for its physical operation. The budget depends on the records both for its basic information and also for its effective operation.

There is another important relationship. The principal purpose of the budget is to facilitate the selection of enterprises. In order for an enterprise to yield satisfactory returns it is necessary, first, that conditions on the specific farm be favorable to it and, second, that it be operated efficiently. Thus the fact that a certain crop or livestock enterprise has failed to yield satisfactory returns does not necessarily indicate that it should be left out of the organization. It may be that conditions were favorable but an undesirable technique or inefficient methods have caused it to make a poor showing in comparison with some enterprise that was better managed. Therefore, it is highly important that the efficiency of operation be examined before the budget is drawn up. The use of records is essential to this study of efficiency.

General Plan of the Book

The book is divided into five main parts. The first of these deals with the preliminary budget and the status of the business at the beginning of the farm year. Some of the records of physical

performance are considered immediately after the budget.

The second section describes the more common forms of financial accounts commonly kept on farms. It is assumed that the farmer is already acquainted with the elements of accounting. This book is not intended to teach these principles but rather to apply them to the problems of the farm business. Where it is necessary to consider the elements, the farmer is referred to some one of the many textbooks on this subject.

Part III takes up the highly important problem of analysis and interpretation. Chapters 9 and 10 treat of the presentation of the facts of income. Chapter 11 suggests ways in which the records may be used currently, without waiting for the end of the accounting period. Chapter 12 describes a preliminary analysis of the combined financial and statistical records. Chapter 13 suggests more accurate interpretations of the measure of performance and suggests some of the many inter-relationships between the various parts of the farm business.

Part IV discusses some special problems. Among these are stock share farms, the handling of accounts for perennial crops and orchards and accounts for landlords. It deals briefly with the valuation of farm assets and their depreciation (chapter 16 and 17).

Part V is concerned with the use of feed and labor records and with the more comprehensive analysis of farm enterprises made possible by combining feed and labor records with the financial accounts. Finally, in chapter 21 we take up the revision of the budget in the light of the information made available in the year's records.

(The above is an excerpt from "Farm Records" by John A. Hopkins printed by Collegiate Press, Inc., and for the convenience of the readers may be ordered through the Farmers Digest. $2.50.)

Weed Control in Tobacco Plant Beds

Condensed from The Southern Planter

WEEDS in tobacco plant beds always have been troublesome. They sap the soil moisture and available plant food and crowd out the young seedlings. The weeding of plant beds is a tedious, back-breaking job that all tobacco growers detest. Furthermore, working in plant beds tends to spread the destructive blue mold and mosaic diseases.

The burning and hand weeding of beds is, apparently, as definitely on the way out of farm practice as the use of the cradle for harvesting grain and the kerosene lamp in the home. Treating the beds in the fall with a heavy dose of calcium cyanamid kills the weed seeds and leaves a clean bed for seeding in the late winter or early spring.

All of the tobacco experiment stations are at work on materials, methods of application and means of increasing effectiveness. Superintendent E. M. Matthew, Virginia Experiment Station, Chatham, found last year that where 1 pound of cyanamid was used per square yard of bed in October, 107 weeds were pulled the next spring; whereas, in the non-treated area 829 were collected per square yard in two pullings, and the weeds continued to come up. Where three-quarter pound of Urea was used per square yard, 142 weeds were pulled. No nitrogen was used in the plant bed fertilizer, but the plants were top-dressed with nitrate of soda.

Tests on a large number of farms in Virginia, Maryland and the Carolinas during the past several years have demonstrated that the fall treatment is quite practical and successful. In the fall of 1939, H. B. Claiborne, Mecklenburg County, Virginia, treated a bed which the previous season had required 15 days of hand weeding and this spring he picked all the weeds from it in less than a day.

The secret of success with the treatment is to make up a finely pulverized seed bed in the fall and evenly broadcast the cyanamid over it, using 1 pound per square yard for average soil. On light land, use ½ to ¾ pound per square yard; on heavy clay soil use 1½ to 2 pounds. The material is thoroughly mixed with the top 3 or 4 inches of soil by hoeing, discing or harrowing. The bed is left level and tobacco seed is not sown for 60 to 90 days, or more, after the treatment. At seeding time, only a garden rake is used for cultivation. This insures a firm seed bed and the shallow cultivation does not bring any untreated soil to the surface.

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The 4-H Clubs

Gertrude L. Warren

United States Department of Agriculture

THE 4-H Clubs of the United States constitute the largest rural youth organization in the world today. During 1939, the membership including the territories of Alaska, Puerto Rico and Hawaii exceeded 1,300,000 rural young people between the ages of 10 and 21. A large increase in enrollment was also noted in many countries of South America, Asia, Africa and in several countries of Europe, notably Norway, Sweden, Denmark, Finland and Latvia.

Because of the varying types of agriculture in the United States, more than 30 different phases of homemaking and farming may now be undertaken by 4-H Club members. In homemaking, in addition to growing a garden and canning the garden surplus, a club member may plan, prepare, and serve attractive and healthful meals; or may make or select for herself and other members of the family attractive, suitable clothing in keeping with the family budget. Club members may also keep personal accounts, assume a share of responsibility for daily household tasks and, at times, take over the management of the home when their mothers are on a vacation at the State College or at a summer camp. Oftentimes 4-H girls add to the beauty of the exterior of their homes by planting native shrubs and trees or they may help their mothers in the intelligent care of younger brothers and sisters.

In the 4-H agricultural club work, a member may grow an acre or more of cotton, corn, or some other crop, raise a garden, market such fresh vegetables and fruits as may be practicable; raise a flock of poultry; purchase, breed, and care for a sow with her litter of pigs and raise them to maturity; raise a dairy calf to maturity and build a dairy herd; run and repair farm machinery; or conduct some other agricultural phase of work.

Credit is frequently given to the 4-H Clubs or a community for the introduction of better-bred livestock, better seed, better home gardens, and similar improvements. Thousands of club members have bank accounts, a considerable number own livestock, and many have a "go-to-college" fund composed largely of club earnings to which they are adding each year. The 4-H Club program also includes recreation in the form of hikes with nature study,

swimming, and games. Other features of the 4-H Club program include music- and art-appreciation work, training in the common courtesies of life, and service of members to their respective club groups and communities.

Each 4-H Club has its officers who conduct the business of the club. A committee appointed by the president and working with the local leader usually plan for the year the club program which is an integral part of the general extension program for the community. These club programs include for each meeting some business, some educational features and some recreation. Such plans include also participation in public team demonstrations, judging work, dramatics, exhibits, camps, and "4-H Club weeks" at the State College of Agriculture or at the State Fair. A large number of 4-H Club members look forward to attendance at various national events such as the National 4-H Club Congress in Chicago and the National 4-H Club Camp in Washington—the crowning event of any 4-H Club experience.

The 4-H Club pledge is:

I pledge—
My Head to clearer thinking,
My Heart to greater loyalty,
My Hands to larger service, and
My Health to a better living, for
My Club, My Community, and My Country.

The national 4-H Club emblem is the four-leaf clover with the letter "H" on each leaf. The national 4-H Club colors are green and white. The national 4-H Club motto is "To make the best better." The price of membership in the 4-H Clubs is the doing of a piece of work that will teach the better way in homemaking or in agriculture.

The 4-H Clubs are organized under the direction of the United States Department of Agriculture and the State Colleges of Agriculture cooperating. In each county, the 4-H Clubs are conducted under the supervision of the county extension agents. Over 8,000,000 rural young people have been 4-H members since the work became nation-wide with the passage of the Smith-Lever Act in 1914. In learning to do by doing, demonstrating better practices, setting worthwhile goals, sharing responsibilities, and serving at home and in the community, 4-H young people learn to respect each other's opinions, to gain confidence in themselves, to express their opinions clearly, and to play and work together happily. Even the informal 4-H meetings in the homes or in the fields have had an important part in helping young people to assume their places as young citizens of rural America. Today, former 4-H

Club members may be found active and successful as leading farmers on various important county and State committees, as well as leaders in the business and professional world interested in assuming their share of responsibility in everything pertaining to human welfare.

Citrus Waste as Cattle Feed

Condensed from Texas Farming and Citriculture

FOR the third successive year feeding tests on beef cattle at the Beeville Experiment Station indicate that dried citrus pulp and peel may be substituted for 25 percent of the ground ear corn ration and the results will approximate the benefits derived from a full-corn ration. This year's tests have shown that if the citrus feed is less expensive than corn, the cattle feeder can profit to the extent of the difference in price of the two feeds. The citrus-fed cattle are said to have a better quality of fat.

The cattle used in the third of a series of tests at the Beeville station in the feeding of varying amounts of dried citrus peel and pulp as a replacement of corn in the fattening ration were 30 head of good quality Hereford steer calves purchased October 30, 1939, at $9.00 per hundredweight. They were dehorned upon receipt and were grazed and fed for a period of 51 days, during which time they gained 96 pounds per head before being started on the test December 20, 1939. The low cost gain secured prior to placement on the test reduced the initial cost from $9.00 per hundred to $8.28 per hundred.

The steers were divided into three lots, one receiving corn, cottonseed meal, silage and salt; the second group received 25 percent citrus, 75 percent corn, cottonseed meal, silage and salt; while the third group received 59 percent citrus, 41 percent corn, cottonseed meal, silage and salt.

It was noted that lot three, receiving approximately 60 percent of citrus feed as a replacement for corn, consumed appreciably less total concentrate feeds than either of the other lots. This result coincided with last year's tests in indicating that a ration containing a large amount of citrus feed is less palatable than a ration consisting largely of corn. During the last 14-day period lot three consumed an average of 9.6 pounds of citrus feed per head daily, which constituted 68 percent, the maximum percentage of corn replaced by citrus.

All three lots received the same amounts of cottonseed meal and were full-fed silage.

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Next Things in Breeding

Condensed from The American Hereford Journal

V. A. Rice
Amherst, Mass.

THIS is commonly spoken of as the scientific age.

When once the shackles of an authoritative past and the fear of theological persecution were removed and men's minds allowed to inquire into the why and how of any and everything under the sun, mankind's progress in the control over the physical world began to accelerate, until it now moves at such a dizzy pace that it bids fair to dash the human race to utter destruction unless means can quickly be found to speed up man's moral and social growth so that he can harness these newly discovered powers of nature to beneficial ends.

In the biological world we had to wait until the 19th century for Pasteur to prove the fallacy of spontaneous generation, for Schleiden and Schwann to establish the fact that all organisms are composed of cells, for Darwin to establish the validity of an evolutionary process and for Mendel to discover the mechanism of hereditary transmission. Old superstitions die hard, old beliefs reappear and especially in fields which parallel man's own nature. Animal breeding is one of these.

Space does not permit even a listing of the old superstitions that still lie athwart the path of progress in animal breeding, telegony, material impressions, inheritance of acquired characters and so on ad infinitum.

Like chemistry, astronomy and physics, however, animal breeding is now a science and technically it is called genetics. When we say anything is a science we simply mean that it is an organized body of knowledge. The scientific method is that of induction. First we observe facts, then we frame a theory which seems to account for all the known facts. Then we contrive experiments to further test our theory and if the theory meets these tests successfully, we assume it is correct but we reserve the right to change it any time it fails to incorporate successfully new facts. If our original working hypothesis fails to meet our first tests, we simply scrap it and start over again.

Finally, we have a theory which will explain and account for known facts of the past and, more important, will allow us to

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predict what will happen in the future. In other words, we pass in this manner from art to science. In art we work on the basis of intuition or guess, while in science we work on the basis of known laws and principles. The one is founded on the sands of wishful hoping, the other on the rock of established, verifiable fact.

Animal breeding started as an art, just when or where we do not, and perhaps we never shall know. At some stage in his long, slow climb from ignorance and savagery man began to tame and to propagate certain of the beasts he found at hand; the dog, the ox, sheep, swine, the horse and many others. Some proved tractable and useful, others probably had to be abandoned. In those early days, five to ten thousand years ago, and even up to the beginning of this century, man's only tool in breeding was selection which rested on the common sense idea that "like begets like." The mechanisms involved in the physiology of reproduction were almost completely unknown and the method by which potentialities were passed along from parent to offspring were a complete mystery.

And so the struggle went on, man gradually conceiving more useful and more economical types to serve his ever growing needs, nature providing the variations which permitted of some progress toward the new ideals. That progress was made no one can question but nature's system is flexible and always includes the possibility of disheartening retrogression. Throughout the rise and fall of ancient empires, Babylon, Greece, Rome—all through the dark ages, from the fall of Rome to the reawakening in the 12th century, animals played an ever increasing role in human history and economy. Poets like Virgil sang the praises of the farmer and breeder, civilized rulers and barbarians alike conquered through the physical aid of the horse and the increased energy derived from a greater inclusion of meat in the diet.

Breeding was by chance or by rule of thumb and the wonder is that any progress could ensue in the turmoil of Europe's almost continual wars.

Finally, in Great Britain, a haven was found where at least war from the outside did not penetrate from the 11th century on and where the best brains of a nation whether in aristocracy or the commoner were centered in the task of animal and crop improvement. These fortunate circumstances flowered in 18th Century Great Britain in an upsurge of really fine animal types: Herefords, Angus, Shorthorns, Devons, Clydes, Thoroughbreds, York-Galloways, Ayrshires, Shires,

shires, Berkshires, Essex, Southdowns, Shropshires, Oxfords, Cotswolds, Leicesters, Lincolns and Cheviots, to mention only a few. Careful thought and study on the part of a few keen, far-seeing men like Bakewell, Tomkins, the Collings and Watson soon devised ways of getting the most out of the rather crude tools of selection and systems of breeding as they then existed.

These were the stock that finally in the 19th century found their way to America. We were the heirs of long centuries of struggle and pioneering in animal breeding. Nature, too, had been good to America. Our deep, rich, virgin soils provided abundant materials through which the inherent qualities of these animals could find full expression. Similar likes soon bound breeders together into breed associations, with unity of purpose and effort, while the variety of breeds provided the necessary spur to progress—breed competition.

Our breed associations, formed for the most part since 1870, have had a most honorable and progressive history. Formed in the first instance to record pedigrees, and thus to protect the purity of their respective breed, they soon took on the task of breed promotion. That their work has been well done is attested both by the stability of the association and the millions of purebreds of all breeds found in America today.

Like the English breeders, who preceded them, our American breeders have done a most excellent job with the tools they had to work with. Lacking scientific knowledge, mistakes were inevitable, but among these men there has never been any hesitation to acknowledge mistakes nor anything but a forward-looking, progressive spirit.

But a two-legged stool, one purity of pedigree, the other promotion, is, we will all admit, far too unstable. We need a third leg to give real stability to animal breeding in the United States. And this scientific age is ready to provide it. It fits in nicely with our ideals as well as completing our alliterations of Pedigree and Promotion. You have already guessed what it is—Proving.

When competition was less keen, mistakes and setbacks could be tolerated. But today they are too costly. Animal breeding, like all the rest of man's endeavors, must be placed upon a sure foundation that will practically preclude the possibility of failure. It is in order to do this that we are feverishly searching for practical methods to prove the breeding worth of our animals so that the gains already achieved may be preserved and future progress insured. More than one breeder in the past has practically reached the pinnacle of success only to

find himself some years later wallowing in mediocrity through the unfortunate choice of a sire or two which by current standards of the sire's own individuality and his pedigree gave every promise of good resulting from his use.

We animal breeders have learned to question old authority. We, too, have learned to doubt "common sense." And we, too, have slowly come to believe that only our reason, backed by observation, calculation and experiment is to be trusted.

Old authorities taught that certain systems of breeding, half-brother to half-sister, grandparent to offspring, and manifold variations of this theme would reproduce certain desirable results. They laid down over 500 theories for controlling sex, many of them necessarily contradictory. They taught that the environment could and did change the hereditary materials in definite ways. All this and more we question, we doubt, yes, we categorically deny. These old authorities were wrong; we will no longer follow their advice.

We used to trust our common sense and subscribe to the blanket statement that "like begets like." Of course, in a general way it does but general guides are not enough now. In this age our tools must be sharp, our compass true. Breeding black to black should give black—but it sometimes gives red, just as polled to polled sometimes gives horns.

The science of animal breeding has slowly unraveled the mysteries of the physiology of reproduction. We know that any organism, calf, pig, colt, lamb or babe, arises from the union of a single egg produced by the ovaries of its mother and a single sperm produced by the testicles of the father. We know that all of the potentialities of said calf, pig, etc., its color, sex, ultimate size, and quality, ability to grow and fatten are in that original egg and sperm from whose union it arose. We know further that the sort of egg or sperm, in terms of its determiners of qualities, secreted by any animal cannot be influenced either by us or by the animal in any way but depends entirely on what this animal received from its parents.

In other words, we now know the mechanism involved in the transmission of characteristics from parent to offspring. If a bull for instance has received the determiners for the polled condition and red color (Pb) in the sperm from his sire, and the determiners for horns and black color (pB) in the egg from his dam, his genetic or breeding make-up for these two qualities is PpBb and since experience teaches us that he will be polled and black, we say that these characteristics are dominant.

Now the crucial question is how will this bull breed? Well, he can only pass along whatever he got from his parents, and you or I or the bull cannot change matters at all. That is, he may in any given sperm, pass along polled and black PB, polled and red Pb, horned and black pB, or horned and red pb. This looks simple, and it is, and it is just as true for size, quality, ability to fatten and a hundred other things as it is for horns and coat color, although many physiologically and economically important qualities are probably governed by several or a hundred determiners rather than by one, as is apparently the case with horns and coat color respectively.

The fact that we do not know the intricacies involved in the transmission of these physiologically and economically important qualities need not dismay us nor hinder our progress toward our goal of more beautiful and more efficient animal types. We know the principles of hereditary transmission and that is all we need to know. As an analogy, I might remind you that we would have been gigantic fools if we had refused to use electricity until we knew exactly what it was. We don't know yet what it is—but we do know its general principles and by means of them we have harnessed it in myriad ways to make our lives more happy and our contrivances more useful.

Science has provided the key which will open up great stores of both wealth and satisfaction to animal breeders. This key is genetics and while it is a thousand times more complicated than the most elaborate Yale key ever dreamed of, with manifold slots, nicks, grooves and protuberances, we don't have to make the key—nature does that for us—all we have to do is to turn the key. In this analogy turning the key means proving our animals. The dairy-cattle breeder is well on the way toward being able to turn the key. He was a pioneer and naturally made some mistakes which it will pay the fat-stock breeder to avoid.

About 40 years ago the dairy breeds inaugurated their Advanced Registry testing. This was a system with great possibilities but they have not in any proper sense been utilized. On the other hand, the system has been exploited for advertising purposes rather than utilized for genetic purposes. True, it was something of an advance over the old recordless days in one sense; but in another sense it was a retrogression because it gave unsound information, and better no information at all than unsound information. A great many high records have been made with dairy cattle, but as this system has been used, testing only a few

selected daughters of a bull, it has given information which may be very misleading.

A recent study of one of the breeds shows that only 1/25 of 1 percent of the bulls registered in the past 40 years had had 10 tested daughters out of tested dams so that a measure of their transmitting ability could be ascertained. However, even with this small number, less than ⅓ of the bulls' offspring which had records had dams that had records. In other words, the information is entirely worthless from a breeding standpoint and when pedigrees of the bulls which apparently were the best transmitters were compared with the bulls which were apparently the poorest transmitters, there was practically no difference in the average run of pedigrees.

This, of course, is but another way of saying that the old foundation bulls of this breed were mixed in their inheritance. They passed along some very good material and, of course, some bad, which is what we would expect since the bull can only transmit what he has received from his parents and up to the time that these bulls lived, no one had made any real attempt to purify them for desirable qualities. In fact, no effective procedure was known for attempting the job.

The herd test which has been adopted by all the dairy breeds, though not used by some to any great extent, is a much better system. In this, all the daughters of a bull must be tested and we can, therefore, get a fairly true picture of what the bull is capable of transmitting. The method is very simple in dairy cattle since we take the average production of the dams to which a bull was mated and compare it to the average production of the daughters of the bull. Since we assume that both parents are jointly and equally responsible for the production level of their offspring, we always place the offspring half way between the two parental levels.

In other words, if a bull was mated to cows that averaged 8,000 pounds of milk and the daughters averaged 10,000 pounds, then the bull's index or genetic breeding level would be 12,000. (Daughters always half way between the parental levels.) Likewise, if the cows averaged 8,000 pounds of milk and the daughters averaged 7,000 pounds, then the bull's index or breeding level would be set at 6,000 pounds of milk.

The same procedure is used with butterfat test. In this way, when all the daughters of a bull are tested, it is possible to know his breeding worth as well as his worth if he were to be moved into another herd. In other words, a bull which had an index of

10,000 pounds of milk on his first 10 daughter-dam pairs would be a good bull to put into a herd where the average level of production was 6,000 pounds. By the same token, this bull would be absolutely valueless in a herd where the average level of production was 12,000 pounds of milk. In other words, the real monetary value of a bull depends quite largely on the type of females to which he is to be mated.

It has been found that we do not need 50 or 60 daughters to ascertain a bull's breeding worth. As a matter of fact, if we get records on the first eight or ten unselected daughters of a bull, and figure his index on that number, we find from experience that the bull's breeding index will have changed practically none at all when he has 80 daughters with records to compare with those of their dams.

Dairy-cattle breeders have organized themselves into several hundred Dairy Herd Improvement Associations, and the Bureau of Dairy Industry in co-operation with the state colleges tabulates the records sent in by the Dairy Herd Improvement Association supervisors. If a bull is being used in a dairy herd improvement association we can write to our state extension dairy specialist and get breeding facts about the bull as soon as he has five daughters with records from dams with records as these facts are published twice yearly. The system would be safer, of course, with 10 daughter-dam pairs than it is with five, so that at the present we are sacrificing a little in accuracy, perhaps, for a gain in speed.

This matter of ascertaining the breeding worth of animals is perhaps more easily accomplished in dairy cattle than it is in fat stock for the simple reason that the dairy animal gives us a daily yield of milk which can be recorded and utilized in such a way as to ascertain the breeding worth of the animals concerned. It is not so easy in fat stock, we, of course, admit, but the necessity for it is just as great, and undoubtedly satisfactory systems for all of the classes of stock will be worked out within the next few years.

That there are great differences in our meat animals both as to individuality and their ability to transmit desirable quality is obvious to anyone who has had any experience or who gives the matter any thought. Breeders have known this from time immemorial but few have kept such records as would prove the case, and even so they would be private records, probably true and honest, but lacking an official stamp.

Experiments for instance have demonstrated that some steers will reach marketable weights

three to four months ahead of others and with considerable difference in amount of feed required for 100 pounds of gain, or the amount and quality of edible product returned in the carcass from a given amount of feed. Similarly, hams have been shown to vary considerably in their ability to increase the carcass and wool qualities of their offspring over those of the dams of said offspring.

And again, "The following data from 12 litters of pigs in the spring of 1932 and seven litters in the fall showed the variation being found among swine of pure breeding. The variation in daily gain for the 12 groups of spring pigs was from 0.56 to 1.41 pounds. Feed consumed for 100 pounds of gain ranged from 360 to 504 pounds. The seven groups of fall pigs ranged in average daily gain from 0.98 to 1.63 pounds; whereas the feed consumed per hundred pounds ranged from 336 to 396 pounds."

Some of the swine record associations have recently set up what they call advanced register programs for testing the desirable characteristics of their sows. In this program, breeders will report litter and breeding data on the sows, together with size, weight, and sex data on their litter. This data will be official and will be attested to by a qualified witness. Later, breeders will report the weight on litters at 56 days; if the sow herself is of acceptable type, has at least 10 teats and raises at least two litters of eight pigs with the combined weight of 320 pounds (300 for gilts—15 months or less at time of farrowing) with each pig over eight weighing at least 25 pounds (20 for gilts) she becomes an AR sow. A boar automatically becomes AR when eight of his daughters from four different sows become AR sows.

In Iowa, the Extension Service is sponsoring a sow herd improvement plan. A record is kept by breeders of the number of pigs farrowed per litter, number raised to eight weeks of age, and the weight of the litter at 56 days. In this way the individual sow's worth regarding fertility, ability to suckle pigs, etc., is measured. Later, representative pigs from each litter are to be judged from the standpoint of suitability on the hoof; and then slaughtered to obtain dressing percents and cut-out values. The Standards are seven pigs per litter for gilts; eight for sows; litter weight at 56 days is 225 for gilts and 250 for sows. In Minnesota, a sow tester has been hired by a group of hog breeders who travels about to secure the litter data and a packing plant is co-operating in securing the necessary carcass data.

As stated previously, we have now arrived at the point where

we can use science in our animal breeding operations, and as we pointed out earlier, science is nothing but systematized knowledge. We just can't tell by looking at an animal how that animal will breed. That's what we have been trying to do in our fat stock.

The qualities that we want in these animals—loins, ribs, rounds, quality, and so on—are there for us to look at; and it was natural that we should assume that an animal would breed as he looks. This is not necessarily so, although it will be when we have, through proper methods of testing, selection and breeding, made our animals pure for the desirable qualities that we want. Then it will be possible to tell beforehand how an animal will breed. There is no short cut to this sort of breeding utopia. It is a long, slow process of keeping records, for only by means of records can we ascertain what is present in the germ cells of our animals.

The greatest lack in animal breeding at the present time is the lack of records. We've got lots of good animals but few of them possess all of the desirable qualities that we want. Our job as breeders is, therefore, two-fold. First, we've got to ascertain what we have and the only possible way of doing this is by record keeping as is being done at the present time in both dairy cattle and hogs, and to some extent in sheep. After we have gotten an answer to this first question as to what is present in the germ cells of stock now living, then the really interesting part of breeding will ensue; namely, that of bringing together this line proved for certain desirable qualities with that line proved for perhaps other desirable qualities, and trying to so combine them that the resulting line will have the desirable qualities of both strains.

Here's where the real science of breeding comes into play. In the past we have practiced the art of breeding, mating this animal to that, putting, we think, these qualities in by the use of certain animals and hoping to get a good combination as a result. However, we have not known in the past just what we have been putting in and, therefore, what we get out is largely a matter of chance. We know now that if we are going to get out a certain combination we have got to put in the proper things at the start and we have got to know what we are putting in. So it is obvious that the first job of breeding is the one of analysis by suitable record keeping to find out what we have got.

The second job will be that of synthesis—putting together known things into a combination that will be an improvement over either or both of the parents. The

breeder's art will still have plenty of opportunity to function. He will have to determine what system of breeding to use, what animals to have for breeding purposes, how close to linebreed or inbreed, and so on ad infinitum. A breed secretary once said to the writer, "You can't breed animals with a pencil," and the reply was made, "I will agree to your statement if you will change with to without." In other words, I want the statement to read, "You can't breed animals without a pencil." I realize that the matings are made out in the barn lot, or on the range, but if they are going to be made intelligently, it has got to be on the basis of factual data, not on the basis of of some hypothetical intuition, or lucky guess.

Probably the least used tool on the average American farm is the lead pencil. The use of a lead pencil merely indicates that the particular farmer is getting down to brass tacks about his breeding animals, the cost of producing certain crops, the efficiency of his various farm operations, or whatnot.

Certainly business can't get along without using up lots of lead pencils or, in this modern age, calculating machines. Certainly science can't get along without records and calculations, and since farming is both a science and a business, it would seem to call for the plentiful use of lead pencils.

Attempts have been made for several years to work out some sort of a method whereby the transmitting qualities of beef animals could be ascertained—something comparable to that now in use with dairy cattle and coming into use with swine. Thus far, no particularly good workable system has been forthcoming, but a lot of progress has been made and investigators have learned a lot of things that should not be done, and they have been able to simplify the problem to a considerable extent.

The things we want in our beef animals, of course, are compact form with short legs, wide body, full crops, loins, rumps and rounds, thick flesh throughout, with good marbling of meat and refinement of bone, and lack of wastiness throughout. The ideal is a vigorous calf which grows rapidly and produces a desirable carcass in the minimum of time and with the minimum of feed consumed. We want animals with as low a feed maintenance requirement as possible but with the ability to eat a lot of feed above maintenance and to turn it into a desirable carcass.

Investigations have shown that those animals with large daily gains, generally speaking, put on that gain efficiently. Just as in dairy cattle, high production is

usually accompanied by efficiency of production. Investigations carried on by workers in the Bureau of Animal Industry, U. S. D. A., have shown that the ratio of weight to height at withers gives a higher correlation with performance factors than any other ratio for a number of different measurements taken, such as length of body, width of shoulders and chest, width of loin, hip, length of leg, depth of chest, and so on. "If any ratio is used corrections will have to be made for difference in fatness, weight and age of animals for these ratios do not remain constant for any one individual during the entire course of its life."

As indicated above, no definite system has as yet been forthcoming from the labors of scientific workers in the Animal Husbandry Division of the Bureau of Animal Industry although considerable progress has been made. We can, I believe, look forward to the time in the near future when a good workable program will have been devised for beef cattle breeders—a system that will enable breeders to measure the transmitting ability of the bulls being used in their herds.

This will probably involve getting such data as height at withers and chest girth, by means of a tape, of the animals in the breeder's herd corrected for degree of fatness, age, and so on. The same data will later be gotten from the offspring of these animals and in this way the transmitting ability of the bull can be ascertained. In other words, the ability of the bull to transmit desirable beef type to his offspring will be known.

There are, in addition, two other important factors more difficult to secure. There is, first of all, the matter of efficient feed conversion. That our animals vary in this regard has often been demonstrated. To measure it, however, requires carefully controlled individual feeding experiments which perhaps only our Experiment Stations or the U. S. Department of Agriculture can be expected to perform. Experiment has already shown that even purebred beef animals vary by as much as 10 or 15 percent in the amount of gain which they will put on from 100 pounds of feed, to say nothing of the differences in quality of carcass which finally result from the same type of feeding.

Records show that about one dairy bull out of three or four is capable of siring daughters which exceed their dams in production in average dairy farmers' herd. Similar tests in beef cattle indicate that, "eight bulls sired calves whose average performance was above the average of the entire group and seventeen sired calves whose average performance was

below." There can assuredly be no question as to the fact that our breeding animals vary in their ability to transmit desirable qualities to their offspring and the principal task facing animal breeding today is to devise practical methods of ascertaining what these differences in breeding abilities are and to state them in a form that will be of use to the average practical breeder.

Another thing required is the measuring of the quality of the carcass produced. Obviously, it is impossible to know exactly what the quality of any given carcass is before the animal has been killed, but since they all go to the butcher eventually, this figure can finally be secured. An index for a beef bull will then probably include his ability to transmit desirable beef type, efficient feed conversion, and a high quality carcass. One hesitates to try to say just what form a Beef Bull Index may take.

Its principal ingredients have just been stated as type, efficiency and quality. For example, we might let Fancy grade equal 5, Choice 4, Good 3, Medium 2 and Plain 1. The grades of the cows could be ascertained approximately and those of their offspring as well. It might be found that the average grade of 10 cows (on the above numerical basis) to which a bull had been mated was 3.7, while the average grade of their offspring was 4.2. And feeding tests might show that these offspring averaged to put a 16.3 pounds of gain for each 100 pounds of digestible nutrients they consumed. This bull's index could then be stated as Bull "Prediction 999: 3.7— 4.2 equals Index 4.7/16.3.

In this we have the average grade of the cows to which the bull was mated (3.7), the average grade of his offspring (4.2), from which his index of 4.7 is calculated on the theory that the offspring should fall half way between the two parental levels. In addition, we have their efficiency of feed conversion, 16.3. Such a bull would be a good one to go into a herd where the average grade was anything less than 4.7 and the average efficiency of feed conversion less than 16.3. Likewise, he should not be used in a herd where the average figures are above these limits. The writer does not offer this as any final form of an index. It is included in this article with some hesitation and mainly for the purpose of creating discussion.

Until such time as a workable system has been devised, the individual breeder can help himself and have a lot of fun by making a start. He could get, for instance, the height of his breeding cows at the withers and their heart girths. He could get the same data from the offspring before

they are sold, and get at least a rough measure of any bull's ability to transmit good type. He can also make a record of the apparent quality of a breeding cow and compare it with the apparent quality of her offspring.

The writer realizes that this is not a proposition that can be worked out easily. It will tax the best brains that we have and be a real challenge to any constructive breeder. There is, so far as the writer has been able to learn, no short cut to the breeding of better beef animals.

When we can set up a procedure which will measure the ability of our animals to transmit type, efficiency and quality, we can eventually, through its use, learn what is present in the germ cells of animals now in our possession. After that has been accomplished and the records made available to breeders, they can plan their matings in order to bolster their particular herds wherever they may happen to be weak, and through proper selection and systems of breeding build even more efficient feed converters.

It will not be necessary to get records on all of the bull's offspring. If the records are secured on the first eight or ten unselected offspring, just as they happen to be dropped in the herd, investigation already at hand indicates that this will be enough for all practical purposes largely for the reason that the sort of germ cell, in terms of characteristics, which a bull secretes will be the same at eight or ten years of age as it was at one, and always entirely depends, as already indicated, on what the bull himself received from his particular parents by way of an egg and a sperm.

It seems advisable to call attention to one other caution regarding the use of an index. In the case of the bull index for dairy cattle, some people tried to uphold the silly notion that the index on milk production and fat test was all one needed in order to breed better cattle. In other words, breeders were advised by some to just use the figures and send their common sense and judgment off on a more or less permanent vacation. If the index could be made complete enough to cover all the details involved, this might be possible, but it is very unlikely that any such index will ever be forthcoming.

The index is not intended to replace experience with knowledge of, or judgment about, our animals, but only to supplement these. An index will probably never be a panacea, but just another additional tool that the intelligent breeder can use to help him in his rather difficult task of molding nature's forms a little more closely to his own ideal of perfection. The main crop on our

breeding farms will always be experience and sound judgment, and indexing is just a way of diversifying a little and putting the whole farm operation on a little more sound business, as well as biological, basis.

The next thing in breeding is so obviously that of getting factual data on our animals to replace the old rules of thumb and clever guessing that there can be no mistaking it. With the proper factual data we can really come to know our animals genotypically, that is, know with a fair degree of accuracy how they will breed. Perhaps there does not seem to be anything particularly romantic or thrilling about this matter of getting factual data, but the romance and the thrill can and will come later when we tackle the job of blending known ingredients in our stock into a uniform, high-qualitied, efficient group of offspring.

Modern conditions demand modern methods, which in animal-breeding terms means devising practical methods for learning the transmitting abilities of our animals. It seems highly probable that such a method for beef breeders will soon be available and the progressive breed and breeders who adopt and use it first will thereby gain a very distinct advantage over their competitors. Hereford breeders have pioneered in many things; it seems highly improbable that they will overlook this newest and sharpest tool of all in Animal Breeding—the Proving of Sires.

Sweet Clover

Condensed from Successful Farming

E. N. Bressman

A little brother of the weeds 30 years ago, but now one of the farmer's best friends, sweet clover continues to grow in popularity as a result of practical farm experience and college research. With its use as a green manure, it got its first attention as a field crop. This use has been adapted to summer fallow at Minnesota's Northwest School and Experiment Station at Crookston. In this area only about six percent of the land is in cultivated crops, which makes some bare fallow necessary to control weeds. Opposition to fallow naturally developed because farmers could not afford to lose the use of their land an entire year, as well as bear the added expense of frequent cultivation necessary to keep the land plowed and to prevent it from blowing.

The answer has been the use of sweet clover, with a partial fallow. The first crop of sweet clover is cut for hay and the land plowed immediately for fallow the remainder of the season; or the first sweet-clover crop is pastured, after which the land is plowed and fallowed. If soil-improvement is a major interest, the first crop can be plowed under. In years of sufficient moisture it is possible to use the first crop and plow under the second, altho this is hazardous in years when rainfall is deficient. On heavy black soils of the station during a year of serious drought damage, it was found that yields of wheat, oats, barley, and flax on land that had been in complete fallow the year before were not significantly greater than yields of the same crop which had grown one hay crop of sweet clover with subsequent fallow. Eradication of sow thistle and quack grass has been accomplished as effectively by beginning fallow in midsummer as by starting it earlier. Furthermore, the use of sweet clover has made some return from the land and reduced the number of cultivations as well.

The Iowa Experiment Station has found that Hubam increased the yield of corn 50 percent more than red clover, and the biennial sweet clover 120 percent more than red clover.

Grown alone, sweet clover has not always proved effective for erosion-control in the semi-arid regions. North and South Dakota fields seeded to the crop have

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blown badly the year following sweet clover, as the soil was in a very loose, flaky condition. Like alfalfa, it tends to dry out the soil, causing deep cracks in the fields in dry years. Of course, a crop of sweet clover plowed under before a corn crop may be very detrimental to yields in a dry season.

Regarding pasturing purposes, there is a great deal of disagreement among the best of livestock farmers. While thousands of acres are annually grazed, there is always the threat of bloat; yet many say that advantages of the crop are great enough to justify an occasional loss. In Cavalier County, North Dakota, B. E. Groom is an enthusiastic sweet-clover raiser, who uses it not only for soil-conditioning, but also as pasture and hay for a flock of sheep and 50 head of white-faced breeding cows. Groom has an unusual way of preparing seed to get his remarkably good stands. While he puts out a considerable acreage each year, he has never yet had it fail to catch and believes this consistent success is the result of giving the seed a good bath just before it is planted. Bags are filled half full of seed and soaked for 24 hours in the stock tank. When the soaking is finished, the seed is swollen so that each bag is full. It is planted immediately, 3 pounds to the acre, with wheat, and it grows readily. Groom fallplows as much of the wheat and sweet-clover land as possible, and then uses a duck-foot cultivator on it. The duck-foot ridges retard soil blowing and help hold snow and water. In the spring, drilling is done across the ridges, but the soil is not worked any more.

The practical limit of rainfall under which sweet clover will succeed in the Midwest seems to be about 20 inches, provided there is sufficient lime in the soil. The crop is particularly valuable because of its ability to withstand alkali better than most other crops. In Illinois the addition of potash to the soil raises the soil-improving value of sweet clover. The repeated growing of this crop, with the accompanying increase of other crops, removes large amounts of potash from the soil, and unless it is present naturally in large quantities, the Illinois station recommends application in the form of straw, manure, or potash fertilizers.

In sections where the lack of lime in small areas of the fields prevents an even stand of sweet clover, other plants will fill in the skips and add variety to the diet of feeding animals, thus lessening the danger of bloating. On soils that heave badly in winter, the grass roots tend to protect the sweet clover. In Wisconsin a mixture of 8 pounds of yellow-blossom sweet clover, 4 pounds of

alsike, and 4 pounds of timothy per acre makes a popular mixture which will average 2 to 3 tons per acre the first year and slightly less the second. The use of some alsike in a mixture insures some legume hay along with the timothy the second year when sweet clover or red clover has died. The alsike will also grow in spots too wet for other legumes.

Improved strains are being announced from several experiment stations each year. A man who has not yet found a strain that exactly suits his conditions will do well to keep in touch with the crops departments at several neighboring state experiment stations. For pasture purposes, Evergreen, a late blooming variety produced at the Ohio station, is now popular as far west as Nebraska. It remains green 1 to 3 weeks later in the fall of the second year than other strains. It does not set seed abundantly. Other outstanding varieties are Iowa Late White and Madrid White. In Missouri, the white-flowered biennial is generally the most useful, but the yellow-flowered types make a better quality of hay.

Recently the objection to a coarse sweet-clover hay has been overcome by many farmers who have put the crop in their silo. With a preservative such as molasses or corn and cob meal, it produces a palatable feed provided it is cut at the right time.

Feeding and Management of Thoroughbreds

Condensed from The Cattleman

L. J. Horlacher

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IN Central Kentucky, within a radius of 80 miles from Lexington, are 160 farms devoted to the production of Thoroughbred horses. On these farms are about 4,000 Thoroughbreds, the most famous of which is, of course, Man O' War. To produce a Derby winner is the hope of all, but that is an honor that is reserved for only a few. Of 65 Derby winners 53 were bred in the Bluegrass.

Every good breeder of Thoroughbreds knows that his stallions must have the best care and treatment if the results of the breeding program are to be satisfactory. Let me describe briefly how stallions are handled by one of the nation's leading Thoroughbred nurseries.

Commencing about the first of September, the stallions are turned out about four o'clock in the morning and are taken in before the heat of the day. Only stallions that are quiet and are not high strung are permitted to run at night. That is the job of the night watchman, and the practice is continued until the weather gets cool enough to turn them out all day.

About the middle of January, before the beginning of the breeding season, the stallions are exercised briskly under saddle for 30 or 40 minutes each day. This daily exercise continues throughout the breeding season unless a particular stallion is so high strung and nervous that he takes a large amount of exercise in his paddock.

At the close of the exercise period each stallion is brought in and rubbed down and at about eleven o'clock he is ready for his midday feed. About eleven-thirty he is turned into his paddock to graze. While he is in his paddock an effort is made to prevent unnecessary noise that might distract his attention and no mares are permitted in the vicinity. Later in the afternoon he is brought up and the dirt is knocked off his feet. Then he is given a brisk rubdown and is fed for the night.

Yeast is fed to the stallions twice daily. Each received four cakes of yeast per day. The stallions are never allowed to get too fat, the judgment of the groom in this matter being most important. Usually the stallions are allowed

Reprinted by permission from The Cattleman, April, 1940

all the mixed hay (clover and timothy) they will eat. The preferred mixture contains 50 to 60 per cent clover and is cut when the clover blossoms are from the half to full bloom stage. At this time the timothy has headed out and is just beginning to bloom. If alfalfa hay is fed, it has been found best to feed not in excess of eight pounds per day. While a stallion is in the stall he is watered every two hours, care being taken to throw out all the old water and fill the bucket with a fresh supply. After the breeding season the feed of the stallion is gradually reduced and the exercise decreased.

Most foals are dropped during January, February, March and April. Breeders in Kentucky, Virginia, Maryland and California prefer to have foaling occur in these months because the weather usually is quite suitable. The young animals are permitted to grow and develop along with the young grass and the spring atmosphere seems to have a beneficial effect. Then, too, all foals become one year of age on the first day of the following January and they must be prepared for two-year-old racing, so early foaling is desirable.

In-foal mares do better when fed separately rather than in common feeding troughs. Bluegrass pasture is excellent. The following grain mixture is fed: Rolled oats 8 quarts, cracked corn 4 quarts, wheat bran 4 quarts. Four quarts of the mixture are fed morning and night. In addition each mare receives 16 pounds of mixed hay per day.

A mash that gives good results is prepared by mixing 3 sacks of whole oats, 1 sack of bran, 1 bushel of corn that has been soaked over night, 1 quart of whole flax seed and 1 quart of salt. The corn and oats are steamed separately for four hours, until they are well swelled. Enough water is used to float the oats and the corn. The cooked oats are placed in a mixing trough, the corn is added, the flax seed is sprinkled over the top, the salt is added, and then the entire mass is covered with the bran and mixed. The mash is allowed to stand for 2 or 3 hours and is fed while still warm.

Foals begin to eat grain when they are 7 to 10 days of age, and when they are 6 to 8 weeks of age they may have individual feed boxes. After the foals are weaned they are fed rolled oats, wheat bran, clover hay, and a little alfalfa hay. Backward foals with harsh hair coats, whose mothers have been poor milkers, are fed separated cow's milk after weaning. When winter comes each foal is fed 1 to 1½ ounces of cod-liver oil per day.

Legumes Are Making a Grassland Possible

Condensed from Better Crops With Plant Food

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THE trend in agricultural thinking in many parts of the country is towards a grassland agriculture—a type of farming in which grass is not just incidental and taken for granted, but where it receives as much attention and consideration as any of our harvested crops with respect to management, fertilization, and improved varieties. This trend towards more acres in grass will be effective for a long period of years. It will directly affect the production of livestock and dairy products. The use of roughages will increase, and greater emphasis will be placed on roughages of high quality. Improved pasturage, better hay, and superior silages will result. Total feed production may be less, but the cost of production will be lowered.

A shift to grassland type of farming is an expression of the trend from intensive to more extensive farming. While the activities of various Federal agencies are hastening the shift, it is not entirely a result of these agencies, but rather it is the result of the accumulative forces of research and education which have prevailed during the last 50 years. For soil fertility and even the soil itself to be maintained and kept in place, intensive farming, especially on hillsides, must be replaced by a less intensive type; grasslands must be improved; eroded cropland must be returned to grass; and rotations must be lengthened.

Approximately one-half of the farmland in Wisconsin at the present time is listed as pasture. Conservative estimates indicate that 10 to 20 per cent of the land now cropped should be converted to pasture land.

Fortunately, all of this land that is to be devoted to grazing need not be thought of as being composed entirely of shallow-rooted grasses such as blue grass. With grass and grass alone, the outlook for the future is not too optimistic. While grasses have great survival value, they are commonly unproductive and unpalatable during dry, hot weather in the north central region.

The hope of a grassland type of agriculture in regions with climatic conditions such as gener-

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ally prevail in the north central States will depend upon the establishment of deep-rooted, drouth-resistant legumes in association with grasses. Where we speak of grasslands we should include grasses and legume in combination.

The possibility and the feasibility of establishing legumes on old sods have been demonstrated on hundreds of Wisconsin farms during the last twelve years. Wisconsin farmers now appreciate the extent to which the fertility of their pasture soils has been lowered through the sale of livestock and dairy products produced from these pastures over a period of years. Many pounds of lime, phosphate, potash, and particularly nitrogen have been removed in this manner. In many cases the removal of the minerals, lime, phosphate, and potash, accounts for the disappearance of white clover and the decreased production and palatability. Evidence of such lowered fertility is made apparent by weed encroachments, particularly with poor management and in years of drought.

Unless soils are extremely deficient, top-dressing permanent pastures with lime, phosphate, and potash gives very little in the way of immediate returns from shallow-rooted grasses such as blue grass. Particularly is this true under conditions of limited moisture and high temperatures. However, the value of these pastures may be greatly enhanced if, after the needed lime, phosphate, and potash have been applied, the sod is scarified to work in the fertilizer and to prepare a seed bed, and the pasture reseeded to a mixture containing deep-rooted legumes, such as a mixture of sweet clover and red clover, or alfalfa and red clover. Under these conditions the legumes benefit from the lime, phosphate, and potash, and the grass in turn benefits from the legumes which make nitrogen available for use by the grasses.

Restore Soil Fertility

The conversion of eroded cropland to grass-legume mixtures is dependent upon restoration of the supplies of lime, phosphate, and potash in worn-out soils. A few years ago when we tested the soil for acidity only, lime was thought to be the only limiting factor. Later, a lime-phosphate combination was thought to be the answer. Now it has been definitely demonstrated that potash is many times a limiting factor. The extensive soil-testing program now under way in Wisconsin, by which the soil needs for lime, phosphate, and potash are determined, is taking the guesswork out of our grassland improvement. In many cases where the desired results were not obtained with applications of lime

and phosphate, soil tests and demonstrations show that potash was needed in addition. Analyses of several thousand soil samples from old pastures show that 90 per cent of them need lime, 75 per cent need phosphate, and 60 per cent need potash.

A grass-legume mixture provides a palatable feed high in mineral, vitamin, and nutritive value that may be used for pasture, hay, or silage. It provides economical production in keeping with principles of proper land use and soil conservation. It is nature's best protection against losses due to soil erosion. It provides succulence during the hot, dry part of the summer when grasses are dormant. In areas where white grubs are a problem, a good growth of alfalfa or sweet clover will give protection from these pests for a period of years. With regulated grazing, good stands of legumes can be maintained for several years. Even after the legumes have disappeared, the residual benefits to the grass will be in evidence for several years.

Cost of "Keeping" Noxious Weeds

Condensed from The Dakota Farmer

U. J. Norgaard
Extension Agronomist

WHEN a landowner is confronted with the problem of controlling or eradicating a noxious weed like a creeping jenny or leafy spurge, he seriously considers these questions: "Can I afford to eradicate the pest?" "Isn't the cost prohibitive?" "Will it cost me more than the land is worth?"

These are pertinent questions and unfortunately the conclusion arrived at oftentimes is that the situation is more or less hopeless, even in localities where land value and productivity is relatively high.

However, suppose that the landowner would study his problem by asking himself these questions: "What does it cost me to 'keep' creeping jenny on my land?" "Will it cost me more to 'keep' them than to eradicate them?"

What will the answer be then?

It must be acknowledged that at the present time there is no easy and costless method of controlling our noxious weeds. Neither is there a costless method to prevent weeds from getting a foothold. It costs some money and effort to keep a farm from becoming infested with noxious weeds, but the dividends are large just the same.

It must be considered that while eradication costs are temporary, the cost of keeping noxious weeds is a yearly one that will make farming a sure loss because of decreased yields and expensive cultivations.

For instance, extensive research on losses caused by creeping jenny shows that year in and year out yields are decreased from 40% to 50% on heavily infested land. Suppose the average yield of wheat on clean land in the community is 12 bushels per acre. On heavily infested land the yield would then average only about 6 bushels per acre. The cost of keeping creeping jenny in this case, is therefore, 6 bushels of wheat per acre. Such a cost far exceeds the cost of eradication.

Experiments in Nebraska

Nebraska Agricultural Experiment Station has determined that with standard tillage equipment the cost per acre per cultivation will average from 30 cents to 35

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cents. Therefore, if 30 cultivations are necessary during the 2-year period of treatment, the total cost would be $9.00 to $10.00 per acre.

These figures include cost of fuel, oil, interest on investment, depreciation, repairs and operators' wages. The total cost of operating the equipment was 70 cents per hour.

In these tests, the creeping jenny stand was reduced 98% to 100% by two years' cultivation. Seedlings subsequently produced by seed carried over in the soil have to be controlled by timely cultivation before seedlings reestablish themselves on the field.

South Dakota Agricultural Experiment Station conducted a cost account experiment on creeping jenny which is outstanding because it points the way to the solution of the noxious weed problem. The outcome of this valuable experiment gives encouragement to the landowner who is compelled to fight this troublesome weed pest.

Four 1-acre fields were selected which were uniform in productivity. One of the acres was free from creeping jenny. The other three were infested to the extent indicated in the table. The treatment and money returns from each acre are likewise indicated in the table.

It will be noted that it cost $13.82 to "keep" creeping jenny on this land each year during the years of 1934, 1935, 1936 and 1937.

Eradication Economically Sound

This experiment merely confirms what farmers are experiencing everywhere. Eradication is economically sound. It must be done.

In the fight against these persistent pests we are gradually learning better and less costly methods of eradication through experience. A landowner who tackles the job of eradicating creeping jenny, for instance, wants to know exactly what the best method is. He must know that he is doing exactly the right thing at the right time. Moreover, he is also entitled to know why these methods are advised.

Creeping Jenny Control

The following outline gives the latest information in regard to creeping jenny control. The outline was compiled by the author in collaboration with C. J. Franzke, Assistant Agronomist, South Dakota State College.

Cultivation Methods

1—*The 2-Year Straight Fallow Method: This method* is based on the principle of exhausting or "bleeding" the root system. This is best done by letting the roots develop new top growth to a certain point, and then cutting off (by cultivation) this new top growth *before the above ground*

plants reach the proper stage to replenish the food supply in the roots.

The timing in this process cannot be guided by rule of thumb but must be controlled by judgment. In some instances the time to cultivate would be when the top growth is three to four inches in length. Under other conditions, the replenishing process, as mentioned above, would not take place, until the top growth was more extensive. A general rule is that it is reasonably safe to let the creeping jenny grow about *eight days* after the first plants appear above ground. Success depends upon never missing an operation at the proper time. (Creeping jenny can, of course, be eradicated by keeping the land black. Experiments have shown, however, that the number of cultivations can be reduced by employment of above system.)

First Year Program

1—Start first year cultivation about two weeks after bindweed starts in the spring. (This may be a plowing six to eight inches deep if ground is hard or trashy.)

2—cultivate four or five inches deep at intervals of about two weeks during the summer (or as often as necessary to prevent the creeping jenny from growing above ground more than *eight days* after the first plants appear above ground.)

3—The last cultivation should be quite deep and the land should be left bare over winter. (Roughen, if necessary, to prevent erosion.)

Second Year Program

1—Cultivate the creeping jenny about every two weeks. (Or as often as necessary to prevent creeping jenny from growing above ground more than *eight days* after first plants appear above ground.)

Variations From the Straight Fallow Method: 1—The 2-Year Fallow-Rye Method: This method is handled exactly like the straight 2-year fallow method described above, except that rye is seeded in the fallow land early in the fall of the second year program. (Rate of seeding, 2 to 2½ bushels per acre.)

2—The 2-Year Fallow-Smother Crop Method: This method is also handled exactly like the straight 2-year fallow method described under paragraph 1, except that if subsoil moisture is very favorable a smother crop (like closely drilled sorghum) may be put on the land in late summer (July 1st), and not pastured or harvested before fall. (If subsoil does not contain reserve supply of moisture, the smother crop should not be seeded.) The value of a smother crop depends on rank growth to hold out sunlight.

Year	Treatment	Number Creepers Per Acre	Crop	Bu. Per Acre	Gross Return Per A.
	ACRE A				
	Fall Plow 7 Inches				
1934	Spring Double-Disked and Harrowed	None	Corn	16.6	$10.79
1935	Spring Double-Disked and Harrowed	None	Wheat	21.3	24.07
1936	First Crop Hay, Second Green Manure	None	Sweet Clover	2,250 lbs.	9.20
1937	Spring Double-Disked and Harrowed	None	Corn	27.4	17.81
			4-Year Average Return		$15.46
	ACRE B				
	Fall Plow 7 Inches				
1934	Spring Double-Disked and Harrowed	286,400	Corn	0.0	0.0
1935	Spring Double-Disked and Harrowed	286,400	Wheat	0.0	0.0
1936	First Crop Hay, Second Green Manure	286,400	Sweet Clover	500 lbs.	$ 2.05
1937	Spring Double-Disked and Harrowed	286,400	Corn	6.9	4.49
			4-Year Average Return		$ 1.64
	ACRE C				
	Mowed 6128				
1934	11 Cultivations (Fallow)	324,320	Fallow	0.0	0.0
1935	1 Plowing, 1 Disking, 6 Cultivations (Fallow)	3,392	Rye	43.4	$23.00
1936	7 Cultivations (Fallow)	87	Rye	34.8	18.44
1937	8 Cultivations (Fallow)	8	Rye	39.8	21.09
			4-Year Average Return		$15.63
	ACRE D				
1934	Spring Plowed 5 Inches, Double-Disked and Harrowed, Cultivated 4 Times	304,960	Sudan Grass	2.3T	$12.05
1935	1 Plowing, 1 Disking, Cultivated 4 Times	242,080	Rye	24.8	13.14
1936	7 Cultivations (Fallow)	36,800	Rye	37.8	20.03
1937	8 Cultivations (Fallow)	6,080	Rye	31.0	16.43
			4-Year Average Return		$15.41

Corn, 65c bu.; Wheat, $1.13 bu.; Rye, 53c bu.; Sweet Clover Hay, $8.18 ton; Sudan Fodder, $5.24 ton.

The Continuous Fallow-Rye Method

1—First Year Program: The fallow practices are handled exactly like in the straight 2-year fallow method described under paragraph 1, but rye is seeded at a heavy rate (2 to 2½ bushels per acre) between September 25th to October 1st.

2—Second Year Program and Years Following:

(a) Harvest rye for grain. (Combine or take shocks off immediately.)

(b) Fallow immediately after harvest and continue to do this *exactly as described under paragraph 1* until rye is seeded in the fall.

Seed between September 25th and October 1st at the rate of 2 to 2½ bushels per acre.

(c) Continue as described under (a) and (b) until eradication is completed.

Chemical Method

Since the cultivation method of eradication is much cheaper where large acreages are involved, the chemical method should be used only where cultivation method cannot be used, such as:

1—Very small patches in cultivated fields.

2—Patches in inaccessible places around buildings and lots.

3—Fence rows and corners.

4—Roadsides, railroad right-of-ways.

5—City grounds.

How to Apply, Spray Method

1—Number of Applications: Two or three required for eradication.

2—First Application: Apply middle of August to middle of September or *at any time in late summer or early fall which is from one to three weeks after a good rain causing good vegetative growth.* Rate of application is from 100 to 150 gallons per acre, using 1½ to 2 pounds of chemical to one gallon of water.

3—Second Application: Apply following season when sufficient growth has occurred, using same precautions as listed under directions for first application. Rate of application is 100 gallons per acre, using 1½ to 2 pounds of chemical to one gallon water.

4—Mop-Up: Mop-up on surviving plants in September or October, using same precautions as listed under directions for first application. Use same strength of solution as described above.

5—Under no condition should land be disturbed while under chemical treatment or until weed is completely eradicated.

How to Apply, Dry Method

1—Number of Applications: Generally only one.

2—Time to Apply: Fall of year, after September 1st.

3—Rate of Application: Four pounds per square rod. (More is needed if land contains a large percentage of organic matter.) Calculate infested areas as including one rod additional strip around entire area.

4—Remove all trash from area to be treated so powder can be put on clean soil. If applied to dry soil, work the ground sufficiently to prevent wind or water erosion.

5—Do not cultivate or disturb soil after treatment or until complete eradication has been secured.

6—Follow-up treatment should be made a year later, if necessary.

Precautions

Pure sodium chlorate when wet or before it comes in contact with organic matter is safe to handle.

But when it becomes mixed with organic matter it becomes readily inflammable and is nearly as explosive as gunpowder. Clothes that have become wet at spraying time should be removed and washed immediately. Dry chlorate saturated clothing may be ignited by friction. Wear rubber boots when applying chlorate sprays. When using dry chlorate do not let it come in contact with grease or oil.

Unity of Dairy Breeds

AN association of dairy breeds was formed at a meeting at Peterborough, New Hampshire, July 5, when representatives met to discuss the problems of the breeder of pure bred cattle. The breeds represented were Guernsey, Jersey, Ayrshire, Brown Swiss, and Holstein-Friesian. These breed organizations have to date registered 1,400,000 animals.

The President of the new organization is Ira G. Payne, East Schodack, New York, Jersey breeder; Vice-President, H. W. Norton, Jr., Brattleboro, Vermont, representing the Holstein-Friesian Association; Secretary and Treasurer is Karl B. Musser, Peterborough, New Hampshire, representing the Guernsey breeders. Ira Inman, of Beloit, Wisconsin, representing the Brown Swiss breed, and C. T. Conklin, Brandon, Vermont, representing the Ayrshires, were elected to serve on the Executive Committee with the officers.

The program of the new organization, to be known as the Pure Bred Dairy Cattle Association, is basically one of help to the dairy farmers of America. The officers point out that modern production would be impossible had not careful breeding practice developed high production livestock through centuries of effort. Pure bred dairy cattle used as seed stock is playing a definite part in economical dairying today. It is the function of this new organization to find ways in which pure bred dairy cattle may further fit into the modern dairy program and be of benefit to the dairy farmers.

—*Guernsey Breeders Assn.*

Equine Encephalomyelitis Immunization

(Sleeping Sickness)

Condensed from Farm and Ranch

T. O. Booth, D. V. M.
State Veterinarian of Texas

EQUINE Encephalomyelitis (sleeping sickness) is one of many diseases of animals caused by a specific filterable virus, i. e., the causative organism is so small that bacterial filters will not retain them.

Before an animal may become affected with the disease it first must be susceptible, that is, it must not be immune to the disease either by having a natural immunity, by having been made immune by having successfully passed through a course of the disease, or by having been made immune by vaccination. Second, the animal must have the living virus introduced into its body by some mechanical means. If these two factors do not occur at the same time the disease will not be produced.

Present knowledge indicates that the chief mechanical means of transmission is by bites of mosquitoes and the disease is also known to be transmitted by certain species of ticks. It is also possible that the disease may be transmitted by other biting insects.

It follows, of course, that to have an outbreak of the disease of any magnitude conditions must be favorable for a good crop of mosquitoes. A larger percentage of cases will develop in areas adjacent to streams, lakes and marshy places than will develop in arid areas. However, it must be borne in mind that the mosquitoes may be blown by the wind for several miles and also that several species of wild migratory and tame birds are known to carry the live virus in their bodies. And it is possible for these birds to carry the disease for long distances and for the local mosquito population to carry the disease from the birds to the susceptible horses and mules.

There are two methods of producing an artificial immunity to the disease:

1. By injecting immune serum into the animal. The immunity produced by the use of immune serum is of only short duration, possibly only ten days to two weeks, and is therefore expensive, and if not carried out continuously during the favorable months. of relatively little value.

2. Use of "Encephalomyelitis

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Chick Vaccine." Just how long this immunity will last has not been definitely determined. However, it is known to produce sufficient protection to prevent the disease during the current season when given in the spring months.

This vaccine is to be given in two doses seven to fourteen days apart, preferably fourteen days. It should be given three weeks before the animals are to be exposed to the disease for most nearly perfect results. However, it may be given during an outbreak to animals not carrying a temperature above normal and not visibly ill with the disease. Naturally its use during an outbreak will not prevent the disease in those animals in the incubative stage of the disease or those vaccinated and inoculated with the virus soon afterwards.

There are a few features which must be taken into consideration in using this vaccine:

1. This is a formalized virus and is of no value if it has been exposed to heat. Even summer room temperature rapidly decreases its immunizing ability. It should be kept refrigerated until used.

2. The vaccine should be a freshly prepared one. An expiration date appears on each bottle of vaccine and the product should not be used after that date.

Several reactions and even deaths occur when this vaccine has been used after the expiration date.

3. There are two strains of this virus in the United States, the eastern and the western strains. So far only the western strain has been found in Texas and adjoining states.

Only the western strain vaccine is of value in this section at present, and the eastern strain of vaccine will not protect an animal against the disease caused by the western strain or vice versa.

There are a few infectious diseases which may be transmitted with vaccination needles, such as swamp fever of horses and mules, malignant oedema, and anthrax. To prevent these complications a sterile needle should be used for each animal and the site of injection should be cleaned and sterilized before each injection.

Inasmuch as "chick vaccine" is made from chicken embryoes it is a foreign protein to horses and mules and a small percentage of the animals vaccinated will experience an anaphylactic or foreign protein shock, and some few will be fatal. This reaction is not a fault of the product or its administration but of the animal itself.

Regarding treatment, there is nothing specific which may be used for all cases.

The virus causing the disease is known as a neurotrophic virus, that is, it is a virus which at-

taches itself to the central nervous system—brain and spinal cord. During the initial stages of the disease this virus may be found in the blood stream but when visible symptoms appear they are indications that the virus has become attached or fixed.

If the disease can be detected before this fixation occurs, injecting anti-encephalomyelitis serum will neutralize this virus in the blood stream and check or favorably modify the course of the disease. However, after the virus becomes fixed the anti-serums can not neutralize it and the serum cannot repair damage done to the brain or nerves by the virus.

Drenching is especially dangerous as most cases have a partial paralysis of the throat and a consequent difficulty in swallowing, which may allow the drench to run into the lungs and complicate the disease with mechanical pneumonia.

Good nursing, keeping the animal comfortable, supplied with fresh cool water, well bedded, free from excitement, etc., will go a long way toward a favorable recovery.

Advice as to medication and special treatments can only be of value for each individual case and its environment.

Stone Yard System

Condensed from Turkey World

Ashley Berridge

Michigan State College

EXPERIMENTAL work in the feeding and housing of turkeys has been carried on at the Lake City Experiment Station, Lake City, Mich., since 1933.

Close confinement of turkeys has aroused the interest and study of many turkey growers, particularly those raising less than 1,000 birds. Methods of housing are being developed to meet local conditions. The use of the brooder house and porch, the battery brooder, the revamped barn or outbuilding, wire floors and even complete wire structures have resulted from the desire of certain growers to rear a few turkeys where they could be watched. As far as is known to the writer, the original "stone yard" for the turkeys was built at Lake City. Its purpose was to keep extra turkeys not needed on feeding tests, where they could be watched.

From 400 to 500 pure-bred Bronze turkeys are grown each year. Up to 1933, these birds were reared under semi-confinement range conditions. In order that accurate experimental feed tests could be made, a rearing house 100 ft. long and 25 ft. wide was built and occupied that year. It contained 10 pens, each 10 ft. wide and 25 ft. long, capacity 30 turkeys each. In providing turkeys for these pens, eggs were usually incubated from several groups of hens.

The poults left over were bunched together, and they made up a management demonstration flock. That these turkeys might be changed over from semi to close confinement, the first stone yard was built in 1936. Its dimensions were 70 by 80 ft., and at present provides space for 100 turkeys each year. A second yard, 60 by 70 ft. was built the following year. A third similar yard will be completed this season. Each will provide space for 100 turkeys.

To the farmer with other poultry besides turkeys, to the grower with a small farm, and to the near-city dweller with high priced land, the stone yard can be recommended as an inexpensive means for close confinement.

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The building of the yard is not difficult, yet it should be rather carefully planned, since it cannot be changed readily.

The soil is important. Preferably it should be sand or a soil of porous nature. Good drainage is necessary, and when built on clay, the yard should slope to provide drainage. The layer of stones must be deeper on water-holding soils. The secret of a successful stone yard is that each rain will carry away droppings and cleanse the stones. There must never be standing puddles of water in the yard.

The fence should be durable and high enough to keep the turkeys in and intruders out. A fence of woven wire 6 ft. high with either steel or strong wood posts is satisfactory. It is advisable to clip the feathers on one wing of each hen. Heavy toms do not attempt to fly out.

The roost should be constructed to provide protection from the sun and storm as well as a comfortable place for the night. An inexpensive roof of wood, steel, asphalt roofing, canvas or even brush will meet the requirements. Since the stones get hot on a bright summer day, the shelter is often appreciated by the turkeys. The cold winds and rains of autumn can be tempered by burlap sacks tacked on two sides of the shelter. A simple bleacher-shaped roost, 10 ft. square and with the top pole 6 ft. from the ground. The cedar poles are 11 ft. long and 4 in. in diameter. A sloping steel roof is 8 ft. from the ground in front and 7 ft. at the rear. Such a roost costs little to build and is long lived. It must be screened in under the pole roosts and around the lower part so that the turkeys can never come in contact with the droppings.

The stones are put in the yard last. Coarse cobble stones, the smallest 2 in. in diameter, are preferable. Field stones from 6 to 8 in. in diameter are satisfactory. In gravel grading, for road building, many over-sized stones can be had for the hauling. While crushed rock could be used, the rounded stones are much better. In the four years at Lake City the turkeys have not developed sore feet on cobble stones. The first layer of stones should be spread evenly and not less than four to five inches deep. Each spring, the stones should be dragged with a spring tooth drag and fresh stones added to any shallow place. A yard or so of fine gravel can be dumped in one corner for dusting and grit. It should be raked clean frequently.

The turkeys reared on the stone yards, at the Lake City Station, have been free of disease and mature as high quality meat birds. The poults are placed in

the yards at 8 to 10 weeks of age and removed when mature.

The yards have now been used for four years, the rain and sunshine having kept them clean and sanitary. The stone yard is another method of raising turkeys which many growers will find interesting and profitable, with a reduction of labor and disease.

Wool Values

Condensed from Sheep Breeder

Milton Madsen
Utah Agricultural Experiment Station

THE value of grease wool is determined by the amount of clean wool it contains, and the fineness, strength, length and uniformity of the fiber. The percentage of clean wool in any given quantity of grease wool is the principal factor used in determining raw wool values. Prior to manufacturing, most of the wool is handled in the grease state. But even though this is the case the prices are based upon clean wool values. To illustrate the influence of shrinkage upon the price of grease wools, the following hypothetical case is presented. Two lots of similar kinds of wool worth 90 cents per pound scoured basis are to be evaluated. Lot (1) shrinks 65 per cent and lot (2) 60 per cent. The grease value of the two lots is 31.5 cents and 36 cents respectively, or a difference of 4.5 cents per pound of grease wool is caused by shrinkage.

Fleece weights and shrinkage of fleeces vary widely, being influenced by the individuality of the sheep and previous care and management. The shrinkage of any given lot of wool is affected directly by the amount of natural exudations contained in the fleece and the extraneous foreign matter. On account of the hygroscopic nature of wool, the moisture content is also an important factor to be considered in determining wool values.

Wool growers are in need of economical methods by which the percentage of clean wool in the sheared fleeces from each flock can be satisfactorily determined. This would give them a more reliable basis to use in selecting individuals for higher wool production and facilitate the marketing of wool.

From 1926 to 1934, the Utah Agricultural Experiment Station in cooperation with range sheepmen conducted an experiment to

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determine the effect of feed, water, and shelter upon fleeces of Utah ewes. Fleeces used in this study were taken from sheep kept under two widely different conditions. One hundred ewes were secured from range herds to begin the experiment. One-half of this number was farm fed each winter and the other was placed with the herd on desert ranges.

The results of shearing weights and scoured fleece weights of the experiment are summarized in the table. Six years out of the eight the farm group had a larger average shearing weight than the range group. The average shearing weight for the eight years was 9.5 pounds for the range group, and 10.6 pounds for the farm group.

There was a marked variation in shearing weights from one year to the next. This variation is particularly noticeable from the period from 1932 to 1934. Farm and range groups did not respond in a similar manner during the different years. This is in accordance with what might be expected, as climatic conditions during the different years may not exert similar effects on the farm and range.

The average wool shrinkage for the eight years was 66 per cent for the range group and 59 per cent for the farm group, a difference of 7 per cent in favor of the farm-fed sheep. On account of the lower shrinkage of farm wool the average scoured-wool weights of the farm sheep were larger during every year of the trial.

Results of this experimental study indicate the difficulty of determining the wool-producing ability of sheep and the wool values from the grease weights of fleeces. Scoured fleece weights provide a more accurate measure of comparative wool production of sheep kept under different conditions. The fact that shearing weights are not a reliable indication of clean wool weights indicates that there is a definite need at the present time for the development of a rapid and accurate method for determining the percentage of clean wool in any given quantity of grease wool.

From this evidence presented it would seem that the usual practice of wool buyers to pay higher prices for range wool as it is sheared from the sheep than for farm wool is not justified.

Year	Average Grease Weight		Average Scoured Weight	
	Range	Farm	Range	Farm
	Pounds		Pounds	
1926	10.8	11.2	3.7	4.7
1927	12.0	8.9	3.5	4.1
1928	12.3	11.0	3.7	3.9
1929	6.8	10.1	2.5	4.0
1930	8.5	11.1	2.9	4.2
1932	6.3	8.5	2.8	3.9
1933	9.0	12.4	3.3	5.3
1934	9.3	11.6	3.4	4.6

Forage Harvester

Condensed from Capper's Farmer

M. N. Beeler

WHAT he needed, B. S. Knapp decided, was a forage harvester. Desirability of the machine became apparent many years ago when human stamina under a broiling sun was the major factor in making hay. Its feasibility was promised when he saw the first power takeoff on a tractor. By that time he was conceiving multiple application of such a device. Within the last decade, necessity of making meat and milk on rough feeds, grown to prevent ruination of the soil, made it well nigh imperative.

Forages must be grown. And forages offer the best means of reducing production costs. Farmers will learn better how to produce and utilize them. But relief from the drudgery and expense of harvesting and processing them must be provided.

For his own farm, in Monroe county, Michigan, Mr. Knapp already has improvised equipment which has reduced handling labor and expense materially. And full mechanization of forage harvest, he believes, is in sight.

By coupling a portable forage chopper to a remodeled manure spreader equipped with automatic loading and unloading devices of his own design, he has been able to eliminate hand labor in making grass or legume silage, in haying, and in collecting combine straw for bedding. The same equipment also is used in making bundle silage, in processing bundle oats, and corn-soybean fodder. For this last purpose hand feeding is now necessary, but Mr. Knapp plans attachments to convert the outfit into a field ensilage cutter which will handle not only row but sod or drilled crops.

The forage machine consists of a pickup, similar to that used on portable hay presses, and a chopping device similar to that of a field ensilage cutter. It was designed to pick up either dry hay for chopping or green material for ensiling, from the windrow or swath. The machine is pulled by and operated from the tractor power takeoff.

The remodeled manure spreader, pulled behind the cutter, is equipped with a large capacity box into which the cut material is delivered. (This box may be removed when the spreader is used for hauling manure.) During loading in the field, material is discharged into the front end of the box. When it has accumu-

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lated to the desired depth, the drag apron of the spreader is thrown in gear to carry the material to the back of the spreader. Apron speed is regulated by a ratchet drive. This operation is repeated until the box is loaded.

In unloading, the apron is operated by an electric motor belted to a V-pulley attached to the end of the rear spreader axle. As the load moves backward and out of the box it drops into a blower, which carries it to the mow, bin, or silo.

Tests made by Mr. Knapp and H. H. Musselman, agricultural engineer for Michigan State College, indicate the outfit will pick up a 3-ton load of green alfalfa for silage in 10 minutes and unload it in 8 minutes. Two tons of alfalfa hay, 1¾ tons combined straw, or 3 tons corn silage can be loaded in 15 minutes and discharged in 10 minutes. Corn and soybean fodder, both with grain, 2½ tons, is loaded in 15 minutes and unloaded in 12.

In a report of their observations on performances of the outfit they said: "Under present-day methods from 15 to 50 per cent of certain crops is lost during harvesting, storing, and feeding. This waste occurs from excessive exposure of the plants to the elements after cutting; from handling between field and mow, between mow and manger, and finally from refusal by the stock.

"The field harvester eliminates or greatly reduces these losses because forage is harvested and stored without delay, leafy parts are preserved, and stock consume practically all of the cut materials. Further, the chopped feed requires only about half the storage space it does in the uncut state. Thus, on most farms, all the crops grown can be stored under cover, and usually in the most convenient place for feeding or use, with a consequent saving in chore labor and time." Into a dairy barn mow of 21 tons, Mr. Knapp can put 42 tons of chopped feed if the building will support the additional weight.

This reduced storage requirement offers further advantage where new buildings are to be constructed. With chopping equipment or this forage harvester it is no longer necessary to construct an enormous mow for loose hay, straw and bundle feed. In case of bedding, Mr. Knapp and Professor Musselman assert that cut straw, in addition to requiring smaller storage space and being easier to handle, has 50 per cent more absorbing capacity, makes better manure, and is more easily loaded into, and distributed by, the spreader.

The field chopper as now constituted will pick up only material that already has been swathed or windrowed. In making corn silage, Mr. Knapp uses

a binder with carrier removed so bundles are strung out end to end. Then the harvester assembly is drawn along the row and bundles are picked up by three men and dropped on to the conveyor table of the cutter. For processing shocked corn or oats, the outfit is hauled from shock to shock.

"We tried hitching a binder abreast of the tractor so corn bundles would be dropped on to the conveyor table," said Mr. Knapp, "but side draft was too great." Obviously, this method requires more work than an ordinary field ensilage cutter, but it still is an advantage over old methods. "My effort is to develop one machine which, with attachments, will eliminate the multitude of implements required in harvesting forage crops. I think a cutterbar ahead of the pickup cylinder will permit harvesting green alfalfa and other sod silage crops at one operation. The same attachment will handle small grain. I bought a combine for threshing wheat, but I would have been better off to have fed the crop. The cutterbar will enable me to head wheat and oats which will then be ground for hogs and dairy cattle.

"A corn harvester attachment to replace pickup and conveyor will permit use of the assembly as a field ensilage cutter so that the binding and bundle lifting operations will be eliminated. Thus, I can dispense with grain and corn binders, mower, rake, hay loader, shredder, and corn sheller. Four persons can now do the legume silage, hay, straw, and shock corn processing, without arduous labor and the customary discomfort of dust and chaff. With the corn cutter attachments four men also can make row crop silage. Only one man, the tractor driver, is required to handle the outfit in the field when legume or grass silage, hay or straw is being picked up. Extra hands do the hauling."

To provide ventilation in his hay mow, Mr. Knapp installed one 2- by 4-foot shaft, enclosed with hardware cloth, to each 14-foot vent. To divide the vents he uses 4-foot snow fence. "By reason of the air circulation, I can put in hay or other forage containing 25 per cent moisture and it will dry without even sweating. Under ordinary circumstances 20 per cent moisture is dangerous and 18 per cent will cause heating."

New forage harvesters, designed to cut, chop and load roughage in the field, including hays and row crops, have been built and are now being tested by implement manufacturing companies. They are intended to completely mechanize the job of harvesting forage.

A Poultry Problem

Condensed from New England Homestead

Roy E. Jones

MANY poultrymen are confronted with the question "Shall I sell the old hens?" The answer frequently depends on the question of room to carry the old hens and house the early-hatched pullets. There is another answer which is more important than the question of room, as room can be provided if it is worthwhile from the dollars and cents standpoint.

Let us first consider the relation between pullet egg and hen egg prices during the summer and fall. The following table shows the variation between extra large, medium and pullet eggs for the period from May to December, 1939, and demonstrates the importance of having a large percentage of early-hatched pullets and old hens.

TABLE I

Average Egg Price Received by Four Connecticut Cooperatives During 1939

	Large	Medium	Pullet
May	22.7	18.8	15.6
June	28.1	24.2	17.2
July	32.9	28.9	19.0
August	34.0	24.0	15.1
September	37.6	26.1	18.9
October	35.0	24.8	21.2
November	34.1	29.8	26.8
December	25.4	21.3	18.9

It will be noticed in the table above that the difference between pullet egg prices and hen egg prices in May and in December was very slight and that this difference increased up to August when hen eggs were worth more than twice as much as pullet eggs, then decreased until December. During August and September, hen eggs were worth approximately twice as much per dozen as pullet eggs.

If these egg prices of the past can be used as an indication of the future, it can readily be seen that pullets should be hatched earlier to produce most of their small eggs while the difference in price due to size is slight, and that it is wise to have both hens and pullets laying large eggs during the season when the variation in price is high.

Whether or not hens are laying sufficiently well to pay their feed costs plus a reasonable profit can be determined by studying Table II.

Several variable factors affect the production required to pay feed costs, including cost of feed per 100 pounds, amount of feed

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consumed per 100 birds per day, which may vary from 25 to 30 pounds, and net price of eggs received on the farm for the average grade produced. When feed cost per 100 pounds, the price of eggs per dozen, and the amount of feed consumed per day are known, the eggs per 100 birds per day, or the percent production necessary to pay feed costs, may be found in either one of the two right-hand columns of the table above.

The cost of land, houses and equipment or overhead, the cost of flock depreciation or mortality, and the labor cost, even though performed by the owner should also be considered. The feed cost figures given in the table above may be doubled to arrive at the egg production required to pay all costs, including operator's labor.

During the spring and early summer when egg prices are low, there is an urge to cull and sell fowl, particularly if the fowl price is high and the feed cost is high. The necessity for making room for early-hatched pullets is another urge to sell fowl. If the hens are in low production and poor condition, they had best all be sold.

In most cases, the problem is one of culling, corrective feeding and improved conditions.

Flocks laying 70% or better contain very few birds that can be culled out without decreasing production. Flocks laying around 50% usually contain from 5 to 15% birds that can be removed. Flocks laying below 30% usually need corrections in feeding and management before accurate culling work can be done.

Regular culling practiced once or twice each month throughout the year should remove all birds decidedly out of condition. Such birds can be identified in the flock by shriveled comb, yellow color in the beak and shanks, moulting and lack of activity. A thorough culling job can be done only by catching and handling all individuals. This may be easily done by placing a wire across the pen and driving the hens into a catching crate. Culling at night while the birds are on the perches is faster but not nearly so accurate.

TABLE II

Egg Production Required To Pay Feed Costs

		Eggs per 100 hens per day (or percent production to pay feed costs)	
Feed cost per 100 lbs.	Egg price per doz.	25 lbs. per day	30 lbs. per day
$2.00	.20	30	36
	.25	24	29
	.30	20	24
	.35	17	21
$2.50	.20	38	45
	.25	30	36
	.30	25	30
	.35	20	26
$3.00	.20	45	54
	.25	36	44
	.30	30	36
	.35	26	31

Present production quality should be first considered as any hen in heavy production is worth keeping while she continues to lay. Longtime production qualities and physical capacity qualities should be taken into consideration when selecting birds to carry over as breeding stock for the coming year.

Individual hens that show evidence of longtime production qualities, but are not in production at present, may have been broody or may have been victims of improper feeding or management. Such individuals in good physical condition with evidence of ability to come back may be retained provided conditions for summer and fall egg production are going to be made favorable.

Providing room for a considerable number of old hens and the early-hatched pullets at the same time requires the use of a Barracks House or a summer laying shelter. A Barracks House cannot be provided on short notice and may not be necessary if other brooding facilities are available, but the summer laying shelter can be built on short notice, it is not expensive and it may pay large dividends if the old hens would otherwise have to be sold.

The long-season laying shelter recommended offers some distinct advantages for early spring and fall use, compared to a shelter with a roof and wire sides only.

—*New England Homestead*

Culling and Selection—Summer and Fall Observations

	Sections	*High Producers*	*Low Producers*
Present Production	Comb	Red, large, full	Pale, small, shriveled
	Vent	White, broad, moist	Yellow, small, dry
	Eyerings	White	Yellow
	Earlobes	White	Yellow
	Pelvic bones	Wide apart, pliable	Close together, rigid
	Abdomen	Full, soft	Shrunken, hard
Long-time Production	Beak	White	Yellow
	Shanks	White	Yellow
	Skin	Thin, loose, faded	Thick, hard, yellow
	Plumage	Ragged, late moult	Moulting, new feathers
Physical Capacity	Eyes	Prominent, well apart	Small, sunken, dull
	Face	Lean, clean cut	Heavy fleshed
	Back	Broad, ribs and hips	Narrow, ribs and hips
	Body	Deep, front and rear	Shallow, front and rear

Moisture Is Most Important!

Condensed from The Poultry Item

Carl Dossin

Pennsylvania Extension Service

CANDLING, which consists of focusing light rays through an egg, is the method used by buyers to determine the quality or value of eggs. This method is not perfect but is the best that is known today. Fine quality eggs have clean sound shells, small air cells, firm and viscous whites, and indistinct yolk shadows when examined before the candle. The poultryman should do everything possible to produce and market eggs of quality.

Any number of different rations will give satisfactory results. During the winter months, in fact pretty much the year around, it is absolutely essential that *confined* birds be fed a ration which contains some source of vitamin D. Limestone, oyster shell or some other source of shell-forming material should be available to the birds at all times. Too frequently the shell hoppers are allowed to become soiled with litter and fine particles of shell. The birds will consume more shell-forming material when it appears attractive to them. It is a good practice to scatter a small amount of shell on top of the mash in the hoppers to encourage increased consumption.

Too much yellow corn and green feed will add color to the egg yolk and make the shadow more visible when the eggs are candled. Regardless of how fresh they are, a dark yolk under the candle will make that egg look old. It is a common practice among poultrymen to feed liberal quantities of oats to their birds. Oats do not add color to the egg. A heavy intake of oats may reduce the amount of scratch feed consumed and as a result the birds will lay eggs with pale yolks.

Many poultrymen who are producing market eggs only, feel that it is not necesary to supplement the grain-and-mash ration with green feed. Green feed, if fed at all, should be fed at not more than 5 lbs. per day for each 100 birds.

Keeping the layers confined at all times will reduce the number of soiled eggs. Having the dropping boards screened with one and one-half inch 16-gauge wire or 1″ x 2″ welded wire will pre-

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vent the birds from getting their feet soiled from the manure on them. If the birds enter the nests with soiled feet, they are likely to soil all the eggs in the nests. Dry litter on the floor and clean nesting material will also help to reduce this problem. A study conducted at the Missouri College of Agriculture brings out that fewer soiled eggs were gathered from nests filled with shavings, sugarcane pulp, or excelsior than when straw, burlap, ground corn cobs, or cotton seed hulls were used.

It has been the experience of most poultrymen that they get fewer soiled eggs when they are gathered frequently. It is very essential, particularly in warm weather, that eggs be gathered at least three times daily so that the animal heat may be removed from them quickly. Heat is very destructive to egg quality. It is a common practice to use wire baskets for gathering eggs to permit the heat to escape from them. The use of a small house fan to circulate the air in the egg room will reduce the length of time required to cool the eggs.

Eggs should be packed each day after all animal heat has been removed from them. Eggs are always packed in cases with the small end down. When in baskets, the eggs may be on their side or small end up. If this is the case the yolk may move toward the small end of the egg. If the yolk is close to the shell when being candled, the shadow will be darker and consequently the eggs are put in a lower grade.

One to two days' supply of empty cases should be kept in the egg cellar prior to the time they are used. This will enable them to cool and pick up the same amount of moisture as is in the air in the room. The egg cases, both empty and filled, should be kept on racks up off the floor.

Recently poultrymen have been giving serious consideration to either improving or building new egg rooms. It has been shown that low temperature and high humidity in the egg room are essential for maintaining quality. These conditions are not satisfactory for the persons cleaning and packing the eggs. For this reason it is desirable to have a two-room egg cellar. One room for cooling and holding the eggs and the other one for doing the cleaning, grading and packing. Often a small section of the house cellar can be partitioned off with insulating board for the holding room. This room need be no longer than is necessary for holding a couple of days' supply of empty cases, one week's supply of packed cases, and room for the baskets of eggs brought in from the hen house. If possible, use a corner of the cellar for this room so as to have two stone or concrete walls.

If a new egg cellar is to be built, try to build it into a bank so that it will not be necessary to carry the eggs up and down stairs.

Information gathered during the fall and early winter months from poultrymen consigning eggs to auctions brings out the importance of maintaining high humidity and low temperature in the egg room. Auction members' egg cellars were studied because their eggs are sold on state grades. The figures used on "per cent fancy" were for a few sales prior to the time of the visit, for it was felt that conditions in the egg cellars would be about the same as when the temperature and humidity readings were taken. It must be appreciated when reviewing the figures presented that only 100 eggs in each case are inspected and a tolerance of 10% of eggs in the next lower grade is permitted.

Information was also gathered on number of birds to a nest, kind of nesting material, frequency of gathering, type of container for gathering, precooling of cases, methods used for cooling of cases, methods used for cooling eggs, and frequency of packing and marketing. The effect of temperature and humidity on egg quality seemed so important that the farms were classified according to these two factors.

The farms were first divided into two groups, ignoring everything but per cent moisture or relative humidity. One group had less than 75 and the other over 75 per cent humidity as determined by a sling psychrometer.

% Relative Humidity	% Fancy	No. Farms
Under 75	39.4	31
Over 75	95.6	15

The same farms were then regrouped according to temperature, ignoring everything else. The one group had a temperature less than 65 degrees and the other over 65 degrees Fahrenheit.

Temperature	% Fancy	No. Farms
Under 65	61	30
Over 65	51.5	16

The farms then were re-grouped according to low temperature and high humidity, high temperature and high humidity, low temperature and low humidity; and high temperature and low humidity.

No. Farms	Temperature	% Humidity	% Fancy
9	Under 65	Over 75	97.7
6	Over 65	Over 75	92.5
21	Under 65	Under 75	45.1
10	Over 65	Under 75	27

The common method of supplying moisture is by wetting the floor two or three times a day. Another practice is to fasten a pipe along the wall near the ceiling. Many small holes are drilled into the pipe permitting water to drip down the wall. The flow of water can be regulated so that the entire wall can be kept wet at all

times and still not waste the water. The most satisfactory method of supplying moisture is by means of a humidifier set up in the egg cellar. When they are used one will have more satisfactory working conditions, for the floor can be kept dry.

There is always danger from molds when high humidity is maintained. To reduce this danger to a minimum, have a small house-fan circulating air in the egg room. One should also plan some kind of a fresh air intake to help eliminate this problem.

For the Farmer's Library

These books are recommended as outstanding in their field:

Beef Cattle—By Roscoe R. Snapp, Asso. Prof. Animal Husbandry, Univ. of Illinois. John Wiley & Son, Inc. $4.00.
(See Farmers Digest, November, 1939)

Beekeeping—By Everett Franklin Phillips, Professor of Apiculture, Cornell University. Published by the Macmillan Co. $4.00.
(See Farmers Digest, July, 1940)

Breeding Your Own, or Raising Colts for Pleasure and Profit — By Clarence E. Bosworth. The Derrydale Press ($10.00). A book suitable for the breeders of hunters' and saddle horses.

Conservation in the United States—By Gustafson, Ries, Guise and Hamilton. Comstock Pub. Co. $3.00.
(See Farmers Digest, July, 1940

Dairy Cattle and Milk Production—By Clarence H. Eckles, B.S.A., D.Sc., late Chief, Div. of Dairy Husbandry, Univ. of Minnesota. Macmillan Company. $3.60.
(See Farmers Digest, February, 1940)

Feeds and Feeding—By F. B. Morrison, Prof. of Animal Husbandry and Animal Nutrition, Cornell Univ. Morrison Press. $5.00.
(See Farmers Digest, October, 1939)

Farm Meats—By M. D. Helser, B.S.A., M.S., Prof. Animal Husbandry, Iowa State College. Macmillan Co. $2.90.
(See Farmers Digest, January, 1940)

Farm Records—By John A. Hopkins, Ph.D., Asso. Prof. of Eco., Iowa State Col.; pub. by Collegiate Press. $2.50.
(See Farmers Digest, October, 1940)

Livestock and Poultry Diseases—By W. A. Billings, Asst. Prof. of Vet. Medicine, Univ. of Minnesota. Macmillan Co. $3.50.
(See Farmers Digest, June, 1940)

Poultry Husbandry—By Morley A. Jull, Prof. of Poultry Husbandry, Univ. of Maryland. McGraw, Hill & Co. $4.00.
(See Farmers Digest, July, 1939)

Pork Production—By William W. Smith, Prof. of Animal Husbandry, Purdue Univ. Macmillan Co. $3.75.
(See Farmers Digest, September, 1939)

Sheep Production—By Levi Jackson Horlacher, B.S.A., M.A., Asst. to Dean, Col. Ag. Univ. Ky. McGraw-Hill Co. $4.00.
(See Farmers Digest, September, 1940)

Vegetable Crops—By Homer C. Thompson, Ph.D., Prof. Veg. Crops, Cornell Univ. Pub. McGraw Hill Book Co. $5.00.
(See Farmers Digest, May, 1940)

For the convenience of our readers, books listed may be purchased through this Department. Address C. Leavitt Dyer, Farmers Digest, Ambler, Pa.

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